Annexure 10:

Responses to s92 requests prepared by EGL in respect of waste rock stack geotechnical matters

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EGL Ref: 9642, 9745

Oceana Gold (New Zealand) Limited
Macraes Operation

23 August 2024

Attention: Marty Hughes

OCEANA GOLD (NEW ZEALAND) LIMITED
MACRAES OPERATION
MACRAES PHASE 4
WASTE ROCK STACKS - SECTION 92 RFI REPLY

1.0 INTRODUCTION

Engineering Geology Limited (EGL) has been requested by Oceana Gold (New Zealand) Limited to reply to Otago Regional Councils Section 92 request for information items related to the Trimbells and Golden Bar Waste Rock Stack Reports included in the Macraes Phase 4 (MP4) resource consent application. In the reports EGL undertook geotechnical assessment of the waste rock stacks related to the changes that apply as part of the MP4 Project.

For reference the reports are:

- Oceana Gold (New Zealand) Limited, Macraes Operation, Trimbells Waste Rock Stack – Closure Stability Report Dated 02/02/2024, Rev 0, EGL Ref 9745
- Oceana Gold (New Zealand) Limited, Macraes Operation, Golden Bar Waste Rock Stack – Stage 2, Design Report, Dated 23/05/2023, Rev 0, EGL Ref. 9642

As part of this reply the Trimbells Report has been updated to:

- Oceana Gold (New Zealand) Limited, Macraes Operation, Trimbells Waste Rock Stack – Closure Stability Report Dated 23/08/2024, Rev 1, EGL Ref 9745

2.0 SECTION 92 REQUEST FOR INFORMATION ITEMS AND REPLIES

The Section 92 request for information items relating to the Trimbells and Golden Bar Waste Rock Stacks are:

2.1 *RFI: It is noted that different Vs30 values are used for the Trimbells and Golden Bar waste rock stacks: Vs30 =1,000 m/s (Trimbells) and 1,500 m/s (Golden Bar). **What is the justification for this given both rock stacks are founded on bedrock? This has a minor effect on the seismic loading.***

Reply: As background the Vs30 parameter is the time averaged shear wave velocity between the surface and 30m depth. The selected Vs30 parameters for Trimbells and Golden Bar WRS are representative of schist bedrock conditions at Macraes. Site data is used to inform this selection is based on three downhole shearwave velocity measurements undertaken in different schist rock conditions. The testing results for context can be summarised as follows:

Location No.	Location	Rock conditions	Measured Vs30
1	TTTSF	TZ3* Schist	1097 m/s
2	TTTSF	TZ3* Schist Macraes Fault Zone	1208 m/s
3	MTI	TZ4* Schist	1784 m/s

*TZ = Textural Zone

The TZ4 schist is on the footwall side of the Footwall Fault (beneath the Hyde-Macraes Shear Zone) and is stronger and harder than the TZ3 schist on the hanging wall side.

For seismic hazard assessment two cases have been run. One for Vs30 = 1000 m/s and the other for Vs30 = 1500 m/s. Vs30 = 1000 m/s was chosen as a lower bound on the shearwave velocity at Macraes and Vs30 = 1500 m/s was chosen to represent higher velocities at Macraes. Note Vs30 = 1500 m/s is a practical maximum for seismic hazard assessment. Above Vs30 = 1500 m/s there is little data on which to base ground motion prediction equations.

Both Trimbells and Golden Bar WRSs are on TZ3 schist rock foundations. The quality of the TZ3 rock varies and to answer the RFI question simply, the TZ3 rock at Golden Bar appeared more competent and so the decision to use Vs30 =1500 m/s was made, and at Trimbells a Vs30 =1000 m/s was taken as it was closer to the Hyde-Macraes Shear Zone.

The difference between selecting Vs30 =1000 m/s and Vs30 = 1500 m/s is illustrated below in the summary tables of spectral acceleration. The WRS will have a spectral period between 0s and 1s. The difference in seismic loading estimation due to the variance in Vs30 selection is up to 21% for 150 year and 16% for 2500 year return period earthquake ground motions. Performance-wise this will only make a minor difference with slightly more deformation in the rock stack. The previously assessed deformations were up to 80mm at Golden Bar, and Trimbells 200mm. These are relatively small values and therefore any change in the estimation of seismic loading will have little effect on the assessed performance of the WRS.

Spectral Acceleration SA(T), Return Period 150 yr

Period, T (s)	Vs30=1000 m/s	Vs30=1500 m/s	Percent Difference
0	0.08	0.07	-13%
0.1	0.17	0.15	-12%
0.2	0.17	0.14	-18%
0.3	0.14	0.11	-21%
0.4	0.11	0.1	-9%

0.5	0.09	0.08	-11%
0.7	0.07	0.06	-14%
1	0.05	0.05	0%

Spectral Acceleration SA(T), Return Period 2500 yr

Period, T (s)	Vs30=1000 m/s	Vs30=1500 m/s	Percent Difference
0	0.36	0.32	-11%
0.1	0.86	0.77	-10%
0.2	0.83	0.72	-13%
0.3	0.66	0.56	-15%
0.4	0.54	0.46	-15%
0.5	0.45	0.38	-16%
0.7	0.34	0.29	-15%
1	0.24	0.21	-13%

2.2 *For the operating basis earthquake – the bedrock motion is 0.07-0.08g. At Trimbells, 0.176 g is used for the full H analysis. At Golden Bar only 0.07 g is used (i.e. the bedrock motion).* ***Is the Golden Bar acceleration correct as it seems low?***

The reported Kh value at Trimbells does not allow for the effect of out of phase motion through the stack when analysing the full height slide mass; where-as Golden Bar does. This is the difference. This parameter is only used as a screening tool for calculating the factor of safety to determine if it is above 1 indicating a no displacement case. Ultimately the Bray and Macedo (2019) methods to calculate displacement do not rely on this Kh parameter. Therefore, the displacements in the reports would not change by updating Kh.

2.3 *The parameters used for the fine-grained waste rock seem very low and not applicable for a rock fill.* ***Can some discussion on this parameter be provided in section 5.2 of the EGL (2024b) report.***

A paragraph on this parameter has been added to Section 5.2 of the report… EGL is aware that waste rock tipping methods result in some degree of segregation of the coarse fraction from the fine fraction in the rock fill such that the upper layers can be supported by a matrix of silt, sand, and gravels which may be contractive under shear and susceptible to softening if pore pressures increase rapidly during earthquake shaking. Typically, this is not an issued for WRS as they have low internal phreatic surface due to the coarse rock layers providing good drainage. However, because the pit lake will introduce seepage through the WRS, perched water tables are possible and consideration of saturation has been made. An undrained strength to effective stress ratio of 0.2 is selected for the assessment for the 1 in 2500 year Annual Exceedance Probability (AEP) earthquake and post-earthquake stability cases. Under 1 in 150 year AEP shaking softening is unlikely. This strength ratio assumes a partial increase in pore pressure reducing the available strength from the peak drained strength under static loading. It is difficult to assess the strength of such material and therefore EGL has checked stability based on a practical worse case assumption to demonstrate that it is not of concern.

2.4 *The EGL (2024b) report mentions that the stratification results in contrasting strength within the WRS. The analysis only seems to use a stratified model on Figure A04, which is labelled as a post-earthquake scenario. Why is this stratified model not used for standard static and EQ analyses? Given the free draining rockfill, strength loss post-earthquake does not seem likely. Please explain.*

Pore pressure increase is unlikely to be notable under the static shear case or 150 year return period earthquake shaking case. The static strength parameter for waste rock when not softened (i.e. static and earthquake 150yr RP) already also allows for the finer fraction stratification. For the 2500 year earthquake we intend to run finer fraction softened strength. EGL will update the report to include this case. This will result in an increase in displacements. EGL has updated the Trimbells Waste Rock Stack – Closure Stability Report (Rev. 1 of the report, see Section 1).

2.5 *The stratified model (EGL 2024b) only considers circular failures.* ***Is a non-circular failure running along the weak layer not more critical? Please explain.***

Yes, the planar failure is critical. The Trimbells Waste Rock Stack – Closure Stability Report has been updated to include planar failure as a more critical mechanism along the weak layers. This update includes a combined review and update of the:

- Planar slide mechanism
- Seepage condition in the waste rock stack for a layered profile
- Stress condition in the waste rock stack for the layered profile

The updated assessment demonstrates that the waste rock stack performance is acceptable in closure. The update has included a more realistic pore pressure profile. This is documented in the updated Trimbells Waste Rock Stack – Closure Stability Report (Rev. 1 of the report, see Section 1).

2.6 ***Could a hybrid failure along the rock surface occur in Trimbells, resulting in a lower factor of safety? Please explain.***

This is unlikely as the surficial soils beneath the WRS have been stripped for use in rehabilitation and therefore coarse rockfill is in direct contact with the in situ rock surface. A planar failure within the rock mass is unlikely at Macraes. An unfavourable geological structure (fault) would need to be present. This main geological structure in the area that could be problematic is the Footwall Fault beneath the Hyde-Macraes Shear Zone. The geomorphology in the area of the Trimbells WRS does not indicate large scale ancient movements.

2.7 *The EGL (2024b) Trimbells Report adopts a layered model to account for layering that would occur due to the rock placement methodology.* ***Why does the same layering not occur at Golden Bar?***

The layering does occur at Golden Bar. However, it is not critical as the waste rock stack will not become saturated over any notable depth in closure unlike parts of Trimbells WRS which may. Note the strength parameters used for the bulk waste rock material is based on triaxial strength testing on scalped samples at a density targeting an uncompacted material. The triaxial tests are extrapolated using non-linear strength equations for rockfill. As the triaxial tests on the rockfill use the finer fraction of the material sample, the strength parameters inherently take into consideration segregation effects in the rock stack.

3.0 CONCLUSION

EGL has provided replies to the Section 92 request for information. The Trimbells Waste Rock Stack – Closure Stability Report (Rev. 1) assessment has been updated. If there are any further need for further requests for information EGL can assist in further replies.

Your Sincerely
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OCEANA GOLD (NEW ZEALAND) LIMITED
MACRAES OPERATION
TRIMBELLS WASTE ROCK STACK
CLOSURE STABILITY REPORT

Prepared for: 23 August 2024

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23 August 2024

OCEANA GOLD (NEW ZEALAND) LIMITED
MACRAES OPERATION
TRIMBELLS WASTE ROCK STACK
CLOSURE STABILITY REPORT

1.0 INTRODUCTION

The Macraes Operation is located at Macraes Flat in East Otago as shown in Figure 1. Gold and scheelite were initially produced at Macraes by underground mining from the 1890's to the 1920's. Production recommenced for the current operation in 1990 with an open pit mine. The main features of the Macraes Operation are shown in Figure 2.

OceanaGold have proposed extensions at three open pits and creation of a new tailings storage facility for the Macraes Operation called Macraes Phase 4 (MP4). The features of the proposed MP4 are shown in Figure 3. For the purposes of this application, MP4 includes expansion of the operations at the Innes Mills, Coronation and Golden Bar Pits. Waste Rock will be placed in Golden Point Pit, Frasers Pit, Innes Mill Pit, Golden Bar WRS and Coronation North Pit. An additional Tailings Storage Facility (Frasers) will be created in the mined-out Frasers Pit by the placement of a backfill embankment at the northern end. Expansion of the Golden Point Underground, the initial stage of tailings deposition into Frasers Pit and Innes Mills Stage 8 are the subject of separate resource consent applications.

Engineering Geology Limited (EGL) has been engaged by Oceana Gold (New Zealand) Limited (i.e. OceanaGold) to review the closure stability of the Trimbells Waste Rock Stack (WRS). The Trimbells WRS forms part of the Coronation North WRS as shown on Figures 1 and 2. The Coronation North Pit has not been mined to the full depth and therefore the full storage capacity of the Coronation North WRS was not required. The layout of the Trimbells WRS is shown on Figures 4 to 6. The Trimbells WRS is covered by the existing consent for Coronation North WRS and will remain in place in perpetuity.

The Coronation Pit comprising the merged Stage 5 and 6 voids will fill up with water as part of the mine closure plan. The closure plan has a proposed outlet channel (660m RL) at the southern end of the Coronation Pit, which will discharge to Highlay Creek. Highlay Creek is part of the Deepdell Creek Catchment. However, there is a low point in the Northern wall of Coronation Pit (637m RL) that will result in up to approximately 23m of water depth being locally impounded against the Trimbells WRS. This will result in seepage through the Trimbells WRS, ultimately entering the Trimbells Gully Creek. While the Trimbells WRS is in effect damming the water in Coronation Pit, EGL consider there to be no potentially catastrophic failure modes due to the approximately 500m long seepage path length and any piping and backward erosion type failure mechanisms would not be self-sustaining.

2.0 SITE GRID

All plan grids and references to the site are based on mine north which is approximately 45 degrees anti-clockwise from true north.

3.0 DESCRIPTION OF THE TRIMBELLS WASTE ROCK STACK

The Trimbells WRS has a maximum crest level of 675mRL with typical slope angles of 1V:2.5H adopted in the construction. The contoured surface of the WRS has been blended with the adjacent natural slopes. The original ground contours, prior to the development of the Coronation Project are shown on Figure 4 with the footprint of the existing Trimbells WRS shown for context. The existing site contours are shown on Figure 5, illustrating the backfilling of the ephemeral gullies forming the southern catchment of the Trimbells Gulley Creek.

The WRSs on site typically have a layer of coarse rock at the base of a fill layers due to the tip head process, where large rock pieces segregate the material mass as they roll to the bottom of the tip face. The fill layers are approximately 10 to 15m high. This horizontal layering will provide contrasting permeability and strength within the WRS.

4.0 GEOLOGY

4.1. Regional Geology

The basement rock in Central and East Otago comprises Otago schist. The Otago schist is primarily composed of psammitic and pelitic grey schist derived from metamorphism of Mesozoic age sandstone and mudstone. In the area of Macraes Flat, the rocks have been metamorphosed to green schist metamorphic facies, giving a strongly foliated fabric of dark grey micaceous and light grey quartz-rich laminations.

From previous geotechnical investigations for the Macraes Gold Project it is apparent that the prominent geological structure includes a well-developed schistosity with two dominant fault sets. West of the Footwall Fault, that defines the Footwall of the Hyde – Macraes Shear Zone (HMSZ), the schistosity is folded and has a varying trend over the project area revealing a series of anticlines and synclines. Foliation dips either to the northwest, north, west or southwest. East of the Footwall Fault (i.e., the hanging wall) the schistosity has more of an easterly trend. At Coronation the Footwall Fault position is inferred as a subtle feature on the landscape. Unlike Frasers and Round Hill to the south, where gold mineralisation extends vertically for 100m to 120m below the Hanging Wall Shear to the Footwall Fault, at Coronation the gold mineralisation is restricted to a 10m thick Hanging Wall Shear that is underlain by 90 to 100m of unmineralised foliated schist. The Trimbells WRS is located approximately 500m to the north of the proposed Coronation Pit stage 6 extension and overlies the inferred northern extension of both the Footwall Fault and the Hanging Wall Shear

The major set of faults has an eastern trend. They exhibit Miocene (recent tectonic) deformations and are related to formation of the Alpine Fault. This deformation has faulted and folded the surface within Central and East Otago to produce the present-day basin and range topography.

The second set of faults has a northern trend, and the most significant of these is the Hyde-Macraes Shear Zone.

The Hyde–Macraes Shear Zone (HMSZ) comprises a mineralised shear zone which has been mapped for at least 25km by OGL geologists. The HMSZ represents the principal gold bearing ore body exploited by OceanaGold and generally strikes north and dips at about 15° to the east. Tectonic displacement associated with the HMSZ is inferred to be in the order of hundreds of metres, with this movement initiating some 120 to 150 million years ago. The ore-schist zone of the HMSZ consists of predominantly pelite and semipelite, but includes blocks of psammite, typically well foliated and containing mineralised quartz veins.

4.2. Site Geology

Geotechnical investigation for the Coronation North WRS comprised field mapping of the site and review of the borehole investigation and mapping carried out for the adjacent Coronation North Pit (Ref. 1). No further investigations have been undertaken as part of the development of this report.

4.2.1. Soils

The prevalent rock outcrops and head scarps of shallow slips observed on the sides of gullies, show that there is only a thin layer of soil overlying the bedrock.

4.2.2. Schist

The schist observed on site comprises well foliated, highly to moderately jointed semi-psammitic schist.

The foliation is well developed and a walk over survey as part of the original design of the Coronation North WRS showed the foliation generally dipping between 9° and 20° to the northeast on the eastern side of the Coronation North WRS (Ref 1,2). Near the Trimbells WRS, there are two observations that show general dip of 14, and 20° to the North.

The schist is moderately jointed with joints generally steeply dipping between 60° and 80° to the south and southwest or north to northeast (Ref 1,2).

No strength testing has been undertaken on schist in the Trimbells WRS area. Elsewhere on the Macraes Operation the typical unconfined compressive strength of unweathered schist is between about 20MPa and 40MPa, normal to foliation. Schist typically has a lower unconfined compressive strength along the direction of foliation. This is reflective of the layered nature of the rock and the presence of weak, mica-rich laminations. It is anticipated that the schist strength in the underlying Trimbells WRS will be consistent with that found elsewhere in the Macraes Operation area.

5.0 IN-SITU ROCK, AND WASTE ROCK CHARACTERISTICS

5.1. In-situ Rock

A single set of shear strength parameters have been adopted for the *in-situ* rock. The design parameters have been taken as a lower bound of the rock strengths typically used for the pit design at Macraes Operation

Effective cohesion	$c' = 150$ kPa
Effective friction angle	$\phi' = 45°$

The foliations in the rock have not been considered in the stability on the basis that the dip and dip direction are unlikely to significantly influence the stability of the Trimbells WRS. The shear strength functions are summarised in Table 3.

5.2. Waste Rock

Existing tailings and water storage embankments at the site have been successfully constructed using rock from mine waste (primarily slightly to highly weathered schist). Laboratory and field testing has been undertaken on these materials, both prior to construction commencing on-site, and during the operation of the mine, to enable design parameters to be established. These same parameters have been adopted for stability analyses for the Trimbells WRS.

Density (γ)	$\gamma = 21.5$ kN/m^3
Shear strength (τ)	$\tau = 1.29\ \sigma_v'^{\,0.91}$

where σ_v' is the effective vertical overburden pressure (in kPa)

The strength relationship is based on triaxial testing of scalped rockfill samples at a density representative of placement in uncompacted state.

The shear strength functions are summarised in Table 3.

EGL is aware that waste rock tipping methods result in some degree of segregation of the coarse fraction from the fine fraction in the rockfill such that the upper layers can be supported by a matrix of silt, sand, and gravels which may be contractive under shear and susceptible to softening if pore pressures increase rapidly during earthquake shaking. Typically, this is not an issued for WRSs as they have low internal phreatic surface due to the coarse rock layers providing good drainage. However, because the pit lake will introduce seepage through the WRS, perched water tables are possible and consideration of saturation has been made. An undrained strength to effective stress ratio of 0.2 is selected for the assessment for the 1 in 2500 year Annual Exceedance Probability (AEP) earthquake and post-earthquake stability cases. Under 1 in 150 year AEP shaking softening is unlikely (See Section 7.0 for analysis cases). This strength ratio assumes a partial increase in pore pressure reducing the available strength from the peak drained strength under static loading. It is difficult to assess the strength of such material and therefore EGL has checked stability based on a practical worse case assumption to demonstrate that it is not of concern.

6.0 SEISMIC HAZARD

6.1. Background

The site is in an area of low historic seismicity. However, there are some nearby faults that are considered active with low slip rates, but they have the capability of generating large, rare earthquakes. They include the nearby Taieri Ridge and Macraes (Billys Ridge) Faults and the more distant Hyde and Waihemo faults. These faults all have annual mean slip rates of less than 0.5 mm/year but are considered capable of generating earthquakes with magnitudes in the range of about Mw 6.4 to 7.3. The Alpine Fault is the largest and most active fault in New Zealand. It is located about 200 km northwest of the site. It has an annual mean slip rate of 25 mm/year and is considered capable of earthquakes of up to about Mw 8.3.

6.2. Probabilistic Seismic Hazard Analyses

Bradley Seismic Limited was engaged to undertake a probabilistic seismic hazard analysis for the Macraes Operation site in 2021 (Ref. 3). This seismic hazard study was an update of the Geological and Nuclear Sciences (GNS) probabilistic seismic hazard study undertaken in 2005 (Ref. 4). The National Seismic Hazard Model (NSHM) has subsequently been updated in 2022 (Ref 5) with several differences, including a revised earthquake rupture forecast (source) model. The 2022 NSHM spectra are used for this assessment.

Probabilistic estimates of seismic hazard in terms of acceleration response spectra (5% damping) are provided for return periods of 150 and 2,500 years in Table 1. These are derived from the National Seismic Hazard Model (NSHM) 2022 (Ref. 5) with an assumption of Vs30 condition of 1,000 m/s. This representative of a lower bound Vs30 value for schist rock at the Macraes Operation. Vs30 is defined as the average seismic shear-wave velocity from the surface to a depth of 30 m and is used to characterise the site response for the estimation of seismic loading.

7.0 DESIGN AND ANALYSIS

7.1. General

EGL has carried out both preliminary static and seismic stability analyses to confirm that the Trimbells WRS will be stable in closure.

The analyses do not include the stability of potential shear failures into the existing Coronation Pit. The Coronation Pit Stability has been covered by Pells Sullivan Meynink (PSM) in their design for the pits (Ref. 6). The Trimbells WRS generally falls within the footprint and profile of the Coronation North WRS Design. PSM analyses conclude that the Coronation North WRS is a sufficient distance from the Coronation North Pit (about 190m) and extension to the Coronation Pit (about 80m) to not represent a significant stability risk.

The seepage and limit equilibrium analyses of the slope have been undertaken using the SLOPE/W program, Geostudio 2012 (Ref.7). The Spencer solution method (Ref.8) has been used for the analyses of circular potential failure surfaces. The Janbu simplified method (Ref.12) has been used for the analyses of potential block/non-circular failure surfaces.

Seismic stability and shear deformation analyses have been undertaken for both 1 in 150 AEP and 1 in 2,500 AEP levels of ground motion. A 1 in 150 AEP level is comparable to an Operational Basis Earthquake (OBE) and a 1 in 2,500 AEP level is comparable to a Safety Evaluation Earthquake (SEE) typically used in the design of dams. Under an OBE the design intent is that there is only minor damage and under a SEE earthquake damage is permitted so long as the WRS remains stable during and post-earthquake.

A summary of the design criteria for the Trimbells WRS is provided in Table 2. Seepage and stability analyses have been undertaken for a representative Model Section which is a combination of both Section A-A' and Section B-B'. Section A-A' represents the anticipated flow path for seepage originating from the Coronation Pit Lake. Section B-B' represents the steepest section at the toe of the WRS. Therefore, for analysis they have been combined in to the Model Section. The location of Cross Sections A-A' and B-B' are shown in Figures 4-6 and the cross sections with the Model Section are shown in Figure 7.

7.2. Stability

Stability analyses have been undertaken to confirm the Trimbells WRS is likely to be stable in closure. Detailed design analyses will be required to confirm stability. The results are summarised in the following sections.

7.2.1. Pore Pressures

A seepage analysis has been undertaken assuming a Coronation Pit Lake long-term level of 660m RL. This level is controlled by the proposed spillway to the south and results in a head of approximately 23m above the low point in the Coronation pit wall. A rainfall infiltration rate of 20% is assumed for the WRS. The analysis is undertaken for the Model Section. Permeability contrasts expected in the WRS have been considered. The purpose of the seepage modelling is only to determine the likely pore pressure regime for stability analysis. The permeability values applied are summarised in Table 3 and the figures in Appendix A.

7.2.2. Shear Strength Parameters

The design static shear strength parameters for the in-situ rock, and backfill zones are discussed in Section 5. The parameters used in the stability analyses are also summarised in Table 3 and in the figures contained in Appendix A.

7.2.3. Results of Stability Analysis

The results from the static and seismic analyses are summarised in Table 4 with detailed results provided in Appendix A. The results of the stability assessments indicate:

1. Static limit equilibrium Factor of Safety (FoS) for the peak drained condition are all greater than the required 1.5.
2. Static limit equilibrium FoS for the post-earthquake softened condition are all greater than the required 1.2 for the downstream slope.

3. Estimated seismically induced displacements under a 1 in 150 year earthquake loading condition are unlikely.
4. Estimated seismically induced displacements under 1 in 2500 year earthquake loading are estimated to be less than 5 cm for the downstream slope.
5. Estimated seismically induced displacements are small and the post-earthquake stability is adequate.

8.0 RISKS AND MITIGATIONS

The following risks and mitigations are outlined for the resource consent:

- The final slopes of the WRS have been checked to confirm they can achieve a long-term static FoS exceeding 1.5.
- An assessment of earthquake performance of the WRS has been undertaken and indicates satisfactory performance under both OBE and SEE levels of earthquake shaking.
- The WRS is located immediately adjacent to the pit. The effect of the pit on the stability of the WRS has been assessed by PSM. OceanaGold will review the pit stability as the pit is developed. Any instability of the pit affecting the WRS during operation could be mitigated by reprofiling and rehabilitating prior to closure.
- It is recommended that an amendment to the building consent should be applied for that reflects the revised arrangement of the Coronation North WRS and the addition of the toe buttress.
- The Trimbells WRS will potentially dam water in closure within the Coronation Pit to a depth of 23m. Technically, the WRS would be defined as a Large Dam under the New Zealand Building Act (2004) and may require building consent as a dam.
- EGL note that seepage may occur at the toe of the WRS. To avoid local slumping at the toe in closure it is recommended that a toe drain and buttress be considered. This could be may need to be 25m in height and 10m wide at the toe of the Trimbells WRS and would be constructed from selected waste rock material onsite. Further detailed assessment is recommended.

9.0 CONCLUSIONS

This report summarises the stability analysis, risks and mitigations for the closure of the Trimbells WRS. Analyses confirm that the Trimbells WRS meet design criteria for stability. This should be confirmed in detailed design for closure prior to construction of the toe buttress and would support application for an amendment to the Building Consent if considered necessary.

10.0 REFERENCES

1. Engineering Geology Ltd (2016) '*Macraes Gold Project, Coronation North Waste Rock Stack Design Report (Rev. A)*'.

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FIGURES

List of Figures

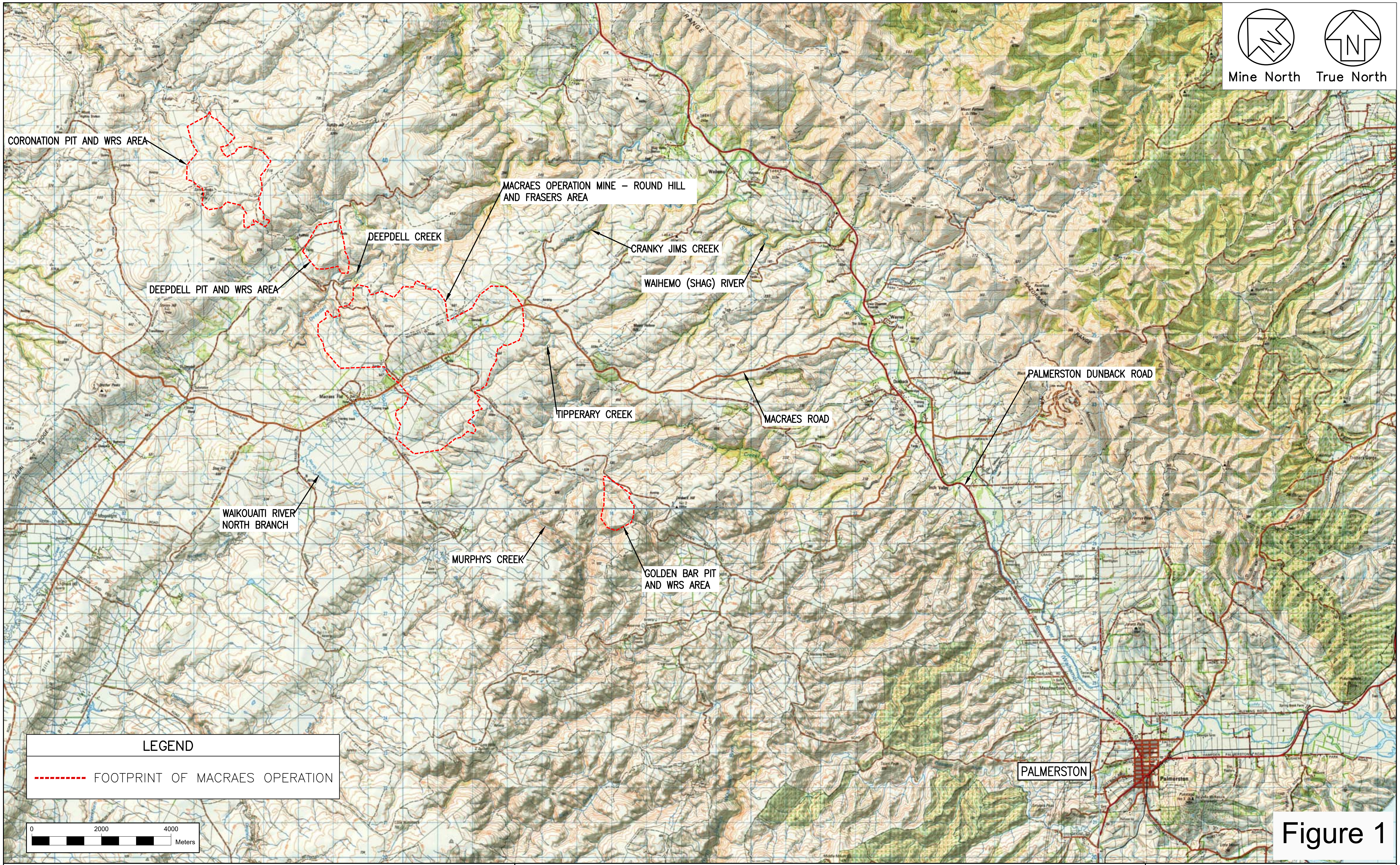

Figure 1

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OCEANA GOLD (NEW ZEALAND) LIMITED
MACRAES OPERATION
LOCALITY PLAN

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Drawn:	R.M.
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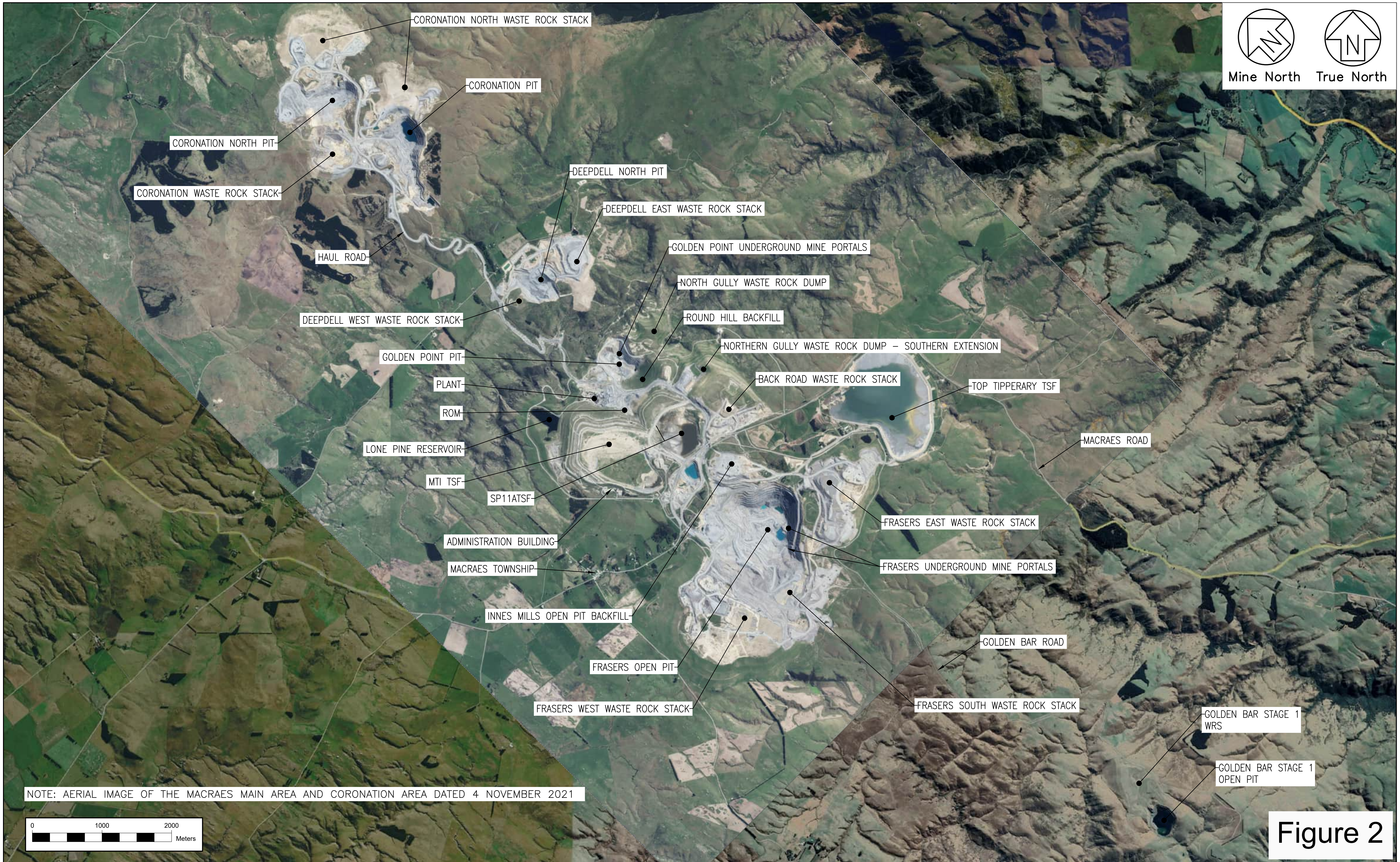

Figure 2

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OCEANA GOLD (NEW ZEALAND) LIMITED
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EXISTING SITE LAYOUT

Figure No.:	9745–Fig 2
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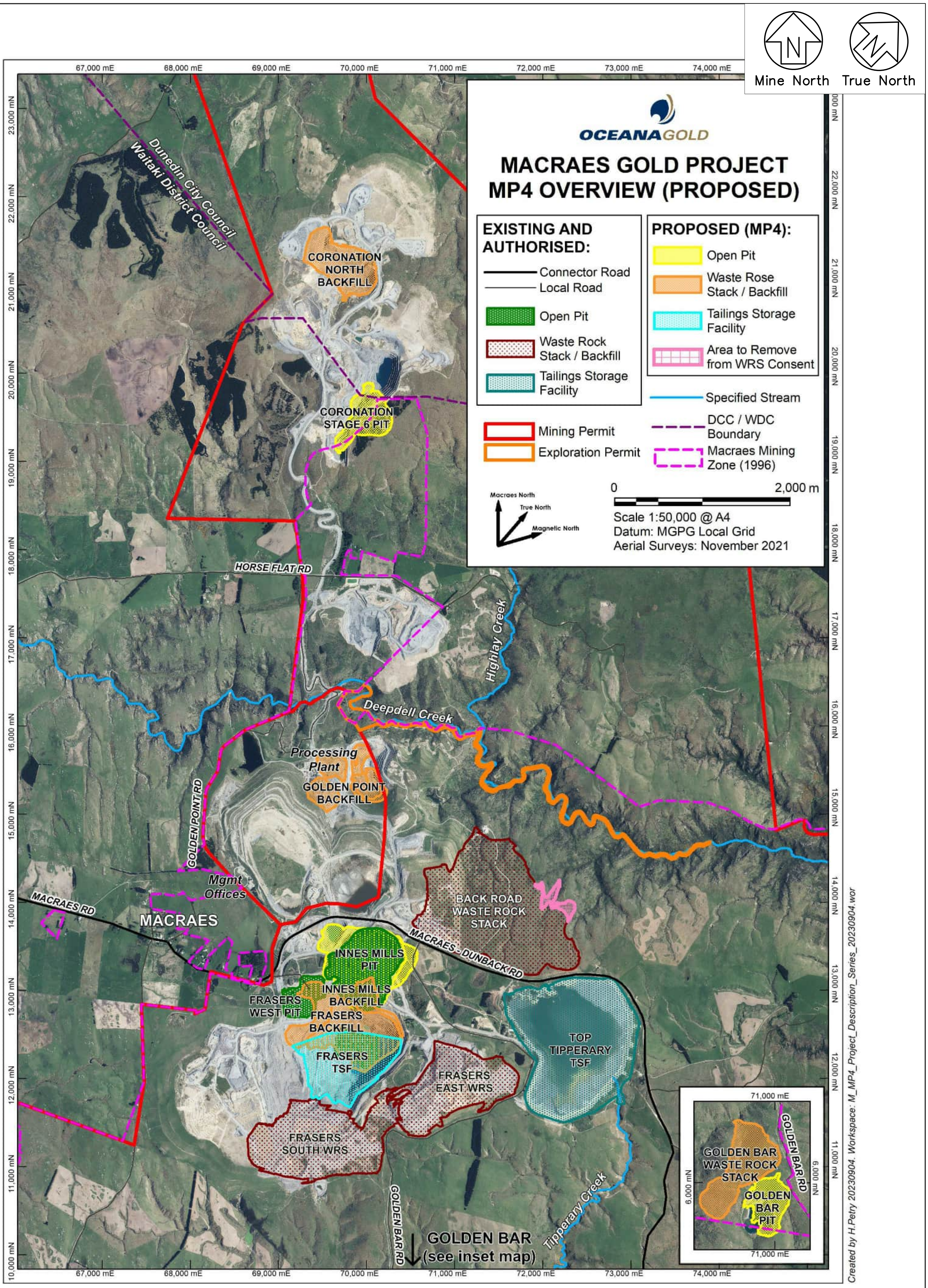

Figure 3

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MACRAES OPERATION
PROPOSED MACRAES PHASE 4 PROJECT
OVERVIEW PLAN

Figure No.:	9745–Fig 3
Date:	January 2024
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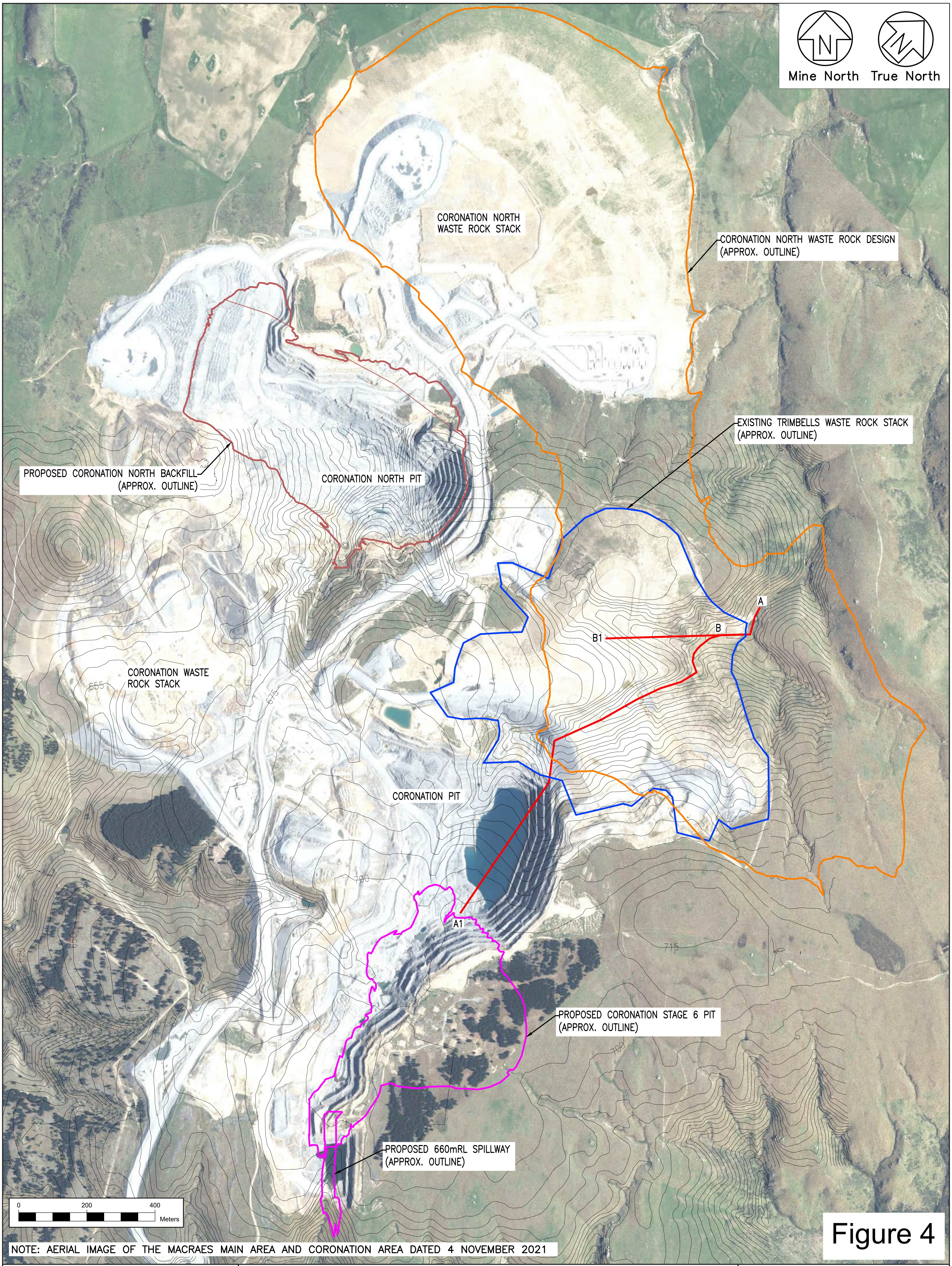

Figure 4

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MACRAES OPERATION
TRIMBELLS WASTE ROCK STACK
ORIGINAL GROUND CONTOUR PLAN

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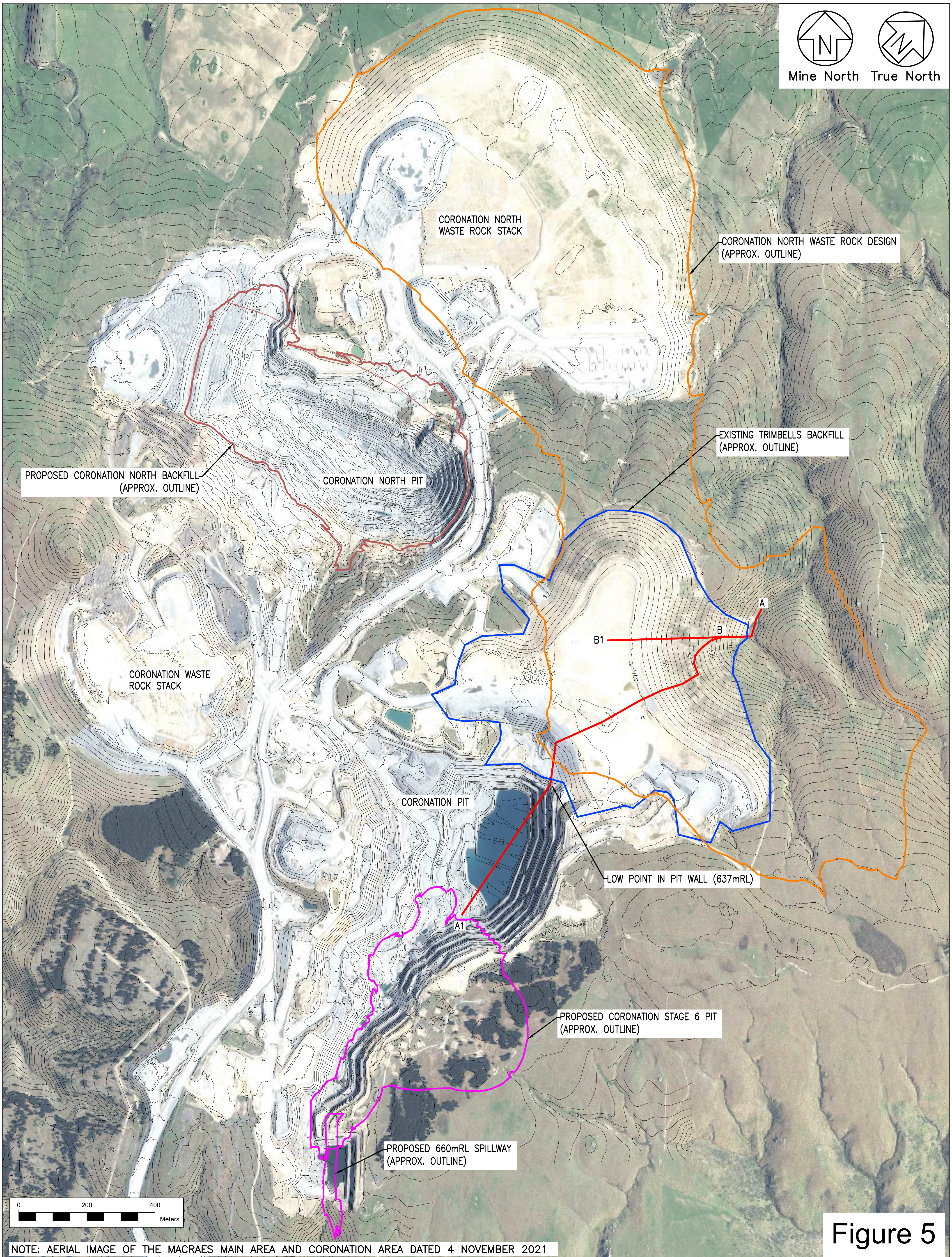

Figure 5

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OCEANA GOLD (NEW ZEALAND) LIMITED
MACRAES OPERATION
TRIMBELLS WASTE ROCK STACK
EXISTING GROUND CONTOUR PLAN

Figure No.:	9745–Fig 5
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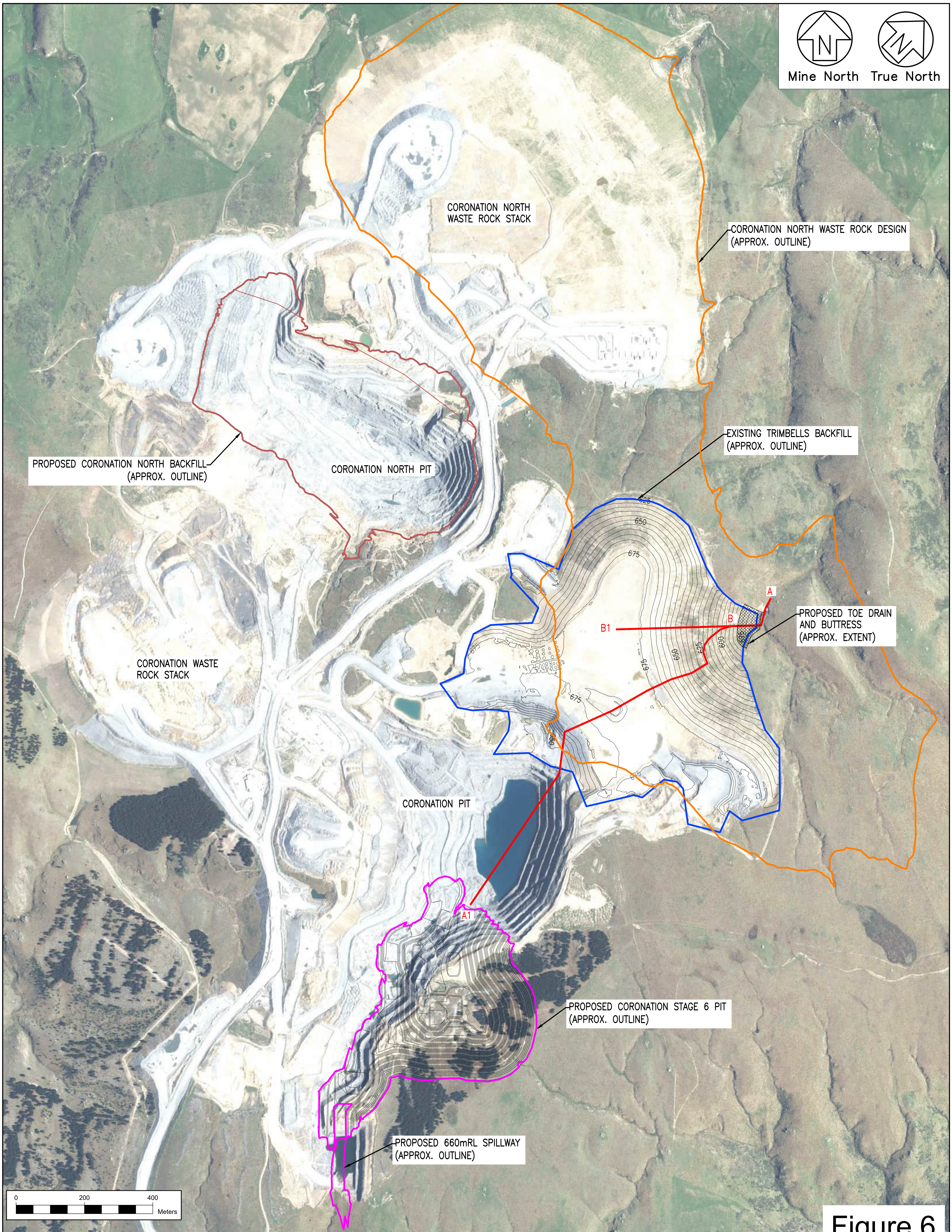

NOTE: AERIAL IMAGE OF THE MACRAES MAIN AREA AND CORONATION AREA DATED 4 NOVEMBER 2021

Figure 6

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OCEANA GOLD (NEW ZEALAND) LIMITED
MACRAES OPERATION
TRIMBELLS WASTE ROCK STACK
PROPOSED LAYOUT

Figure No.:	9745–Fig 6
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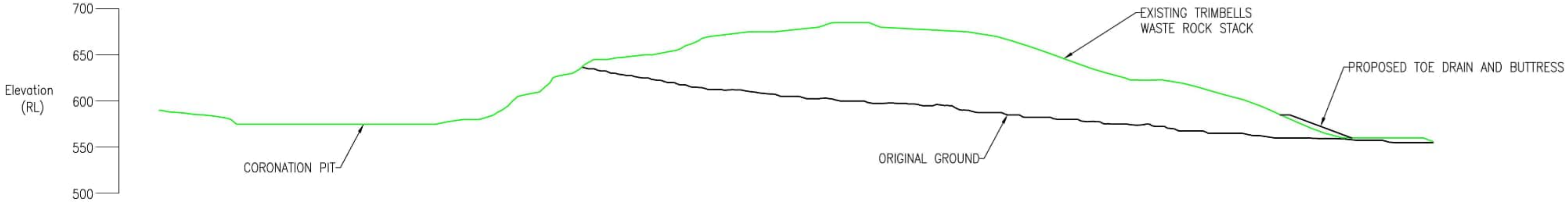

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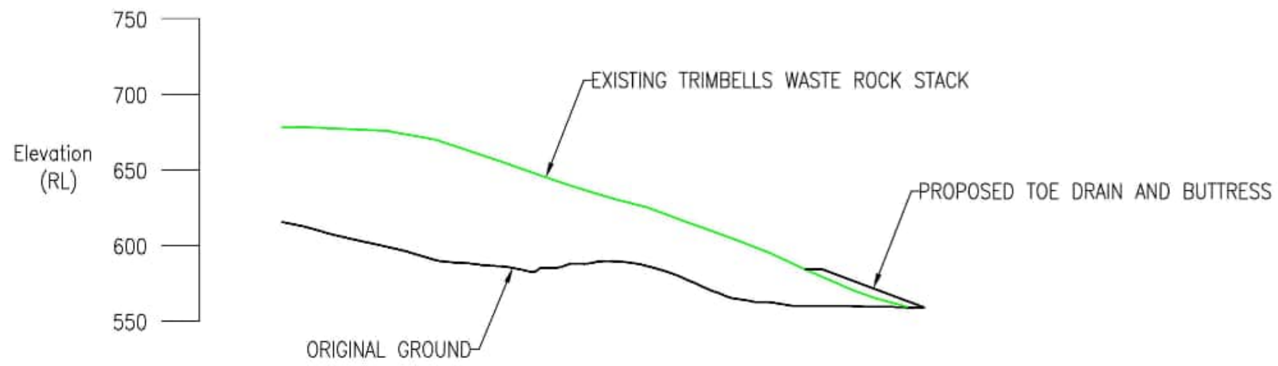
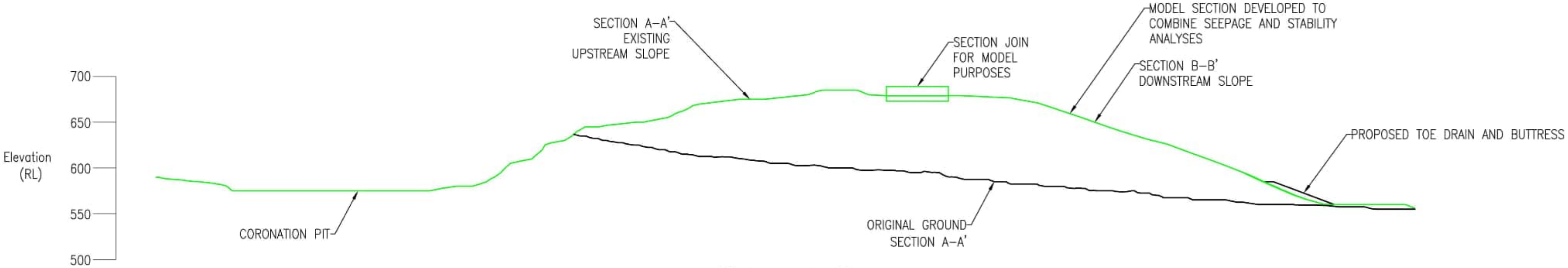


CROSS SECTION B–B1
SCALE 1:5000



MODEL SECTION
SCALE 1:5000

Figure 7

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CROSS SECTIONS

Drawing No.	9745–Fig 7
Date:	August 2024
Drawn:	E.T.
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Filename:	9745–Fig7.dwg

TABLES

List of Tables

TABLE 1 Design Earthquake Response Spectra, NSHM 2022 (Vs30 = 1,000 m/s) and amplification

Period, T (s)	Bedrock SA (g)		Mid Height SA (g)		Crest SA (g)		Spectral amplification base to crest*	
	150 Yr (OBE)	2500 Yr (SEE)	150 Yr (OBE)	2500 Yr (SEE)	150 Yr (OBE)	2500 Yr (SEE)	150 Yr (OBE)	2500 Yr (SEE)
0.0	0.08	0.36	0.22	0.47	0.32	0.62	4.5	1.9
0.1	0.17	0.86	0.52	1.08	0.68	1.48	5.1	2.2
0.2	0.17	0.83	0.50	1.06	0.68	1.43	4.9	2.1
0.3	0.14	0.66	0.40	0.85	0.56	1.14	4.7	2.0
0.4	0.11	0.54	0.33	0.69	0.44	0.93	4.9	2.1
0.5	0.09	0.45	0.27	0.57	0.36	0.77	5.0	2.1
0.7	0.07	0.34	0.21	0.43	0.28	0.58	4.9	2.0
1.0	0.05	0.24	0.15	0.31	0.20	0.41	4.8	2.1
1.5	0.03	0.16	0.10	0.20	0.12	0.28	5.3	2.3
2.0	0.03	0.12	0.08	0.17	0.12	0.21	4.0	1.8
3.0	0.02	0.08	0.05	0.11	0.08	0.14	4.0	1.8

*Allows for waste rock site and topographical type amplification

TABLE 2 Summary of Design Criteria

Design Parameter	Design Criteria
Earthquake Operational Basis Earthquake Safety Evaluation Earthquake	 1 in 150 AEP 1 in 2,500 AEP
Stability ***Static*** Peak Drained (Long Term) Residual Undrained (Short Term, e.g., post-earthquake, static liquefaction) ***Seismic*** Operational Basis Earthquake Safety Evaluation Earthquake	 Limit Equilibrium FoS ≥ 1.5 Limit Equilibrium FoS ≥ 1.2 Minor deformations are acceptable, and the resulting damage is easily repairable Some deformation and damage is permitted as long as the stability is ensured.

TABLE 3 Summary of Material Properties for Seepage and Stability Analyses

<table>
<tr><th>Material</th><th>Density (kN/m^3)</th><th colspan="2">Strength parameters</th><th>Permeability k (m/s)</th></tr>
<tr><td>Waste Rock (Segregated cobbles and boulders)</td><td>21.5</td><td colspan="2">$\tau=1.29\sigma'^{0.91}$</td><td>$1\ x10^{-2}$m/s
ky/kx =1</td></tr>
<tr><td>Waste Rock (Well graded sandy gravelly rockfill with boulders and cobbles)</td><td>21.5</td><td colspan="2">$\tau=1.29\sigma'^{0.91}$</td><td>$1\ x10^{-4}$m/s
ky/kx =1</td></tr>
<tr><td rowspan="2">Waste Rock (Silty sandy gravel)</td><td rowspan="2">21.5</td><td colspan="2">$\tau=1.29\sigma'^{0.91}$
Static and 150yr EQ</td><td rowspan="2">$1\ x10^{-6}$m/s
ky/kx =1</td></tr>
<tr><td colspan="2">$\tau=0.2\sigma'$
2500yr EQ</td></tr>
<tr><td>Insitu Rock</td><td>26</td><td>c'=150kPa</td><td>ϕ' = 45deg</td><td>$5\ x10^{-9}$m/s
ky/kx =0.1</td></tr>
</table>

TABLE 4 Summary of Stability Analyses – Model Section

Loading Condition		**Failure Location**	**Failure Surface**	**Kh (g)(1)**	**FoS**	**Yield coefficient k_y (g)(2)**	**Seismic Displacement (cm)(3)**	**Figure**
Static	Long Term - Peak Drained	Downstream	Circular Planar	-	2.16 2.21	-	-	A02 A03
	Short Term - Residual Undrained (Static Liquefaction / Post Earthquake)	Downstream	Circular Planar	-	1.95 1.60	-	-	A04 A05
Seismic	150 Year Return Period (OBE)	Downstream	1/3H	0.271	1.36 1.37	-	-	A06 A07
			2/3H	0.2	1.50 1.46	-	-	A08 A09
			H	0.176	1.43 1.42	-	-	A10 A11
	2,500 Year Return Period (SEE)	Downstream	1/3H	-	-	0.44 0.44	<0.5 to 5cm	A12 A13
			2/3H	-	-	0.37 0.38	<0.5 cm	A14 A15
			H	-	-	0.28 0.14	<0.5 to 5cm	A16 A17

(1) Kh (g) - average acceleration within the potential failure mass for various return period earthquakes (for pseudostatic analysis only). Out of phase behaviour conservatively ignored.

(2) k_y (g) - yield acceleration within the potential failure mass for an FoS = 1.0, determined using pseudostatic approach.

(3) Estimated seismically induced permanent displacement during an earthquake. The range given here represents the the 84% and 16% probability of exceedance applying the methods set out in Bray and Macedo (2019) (Ref. 11). Results reported are rounded for simplification.

APPENDIX A

SEEPAGE AND STABILITY ANALYSES

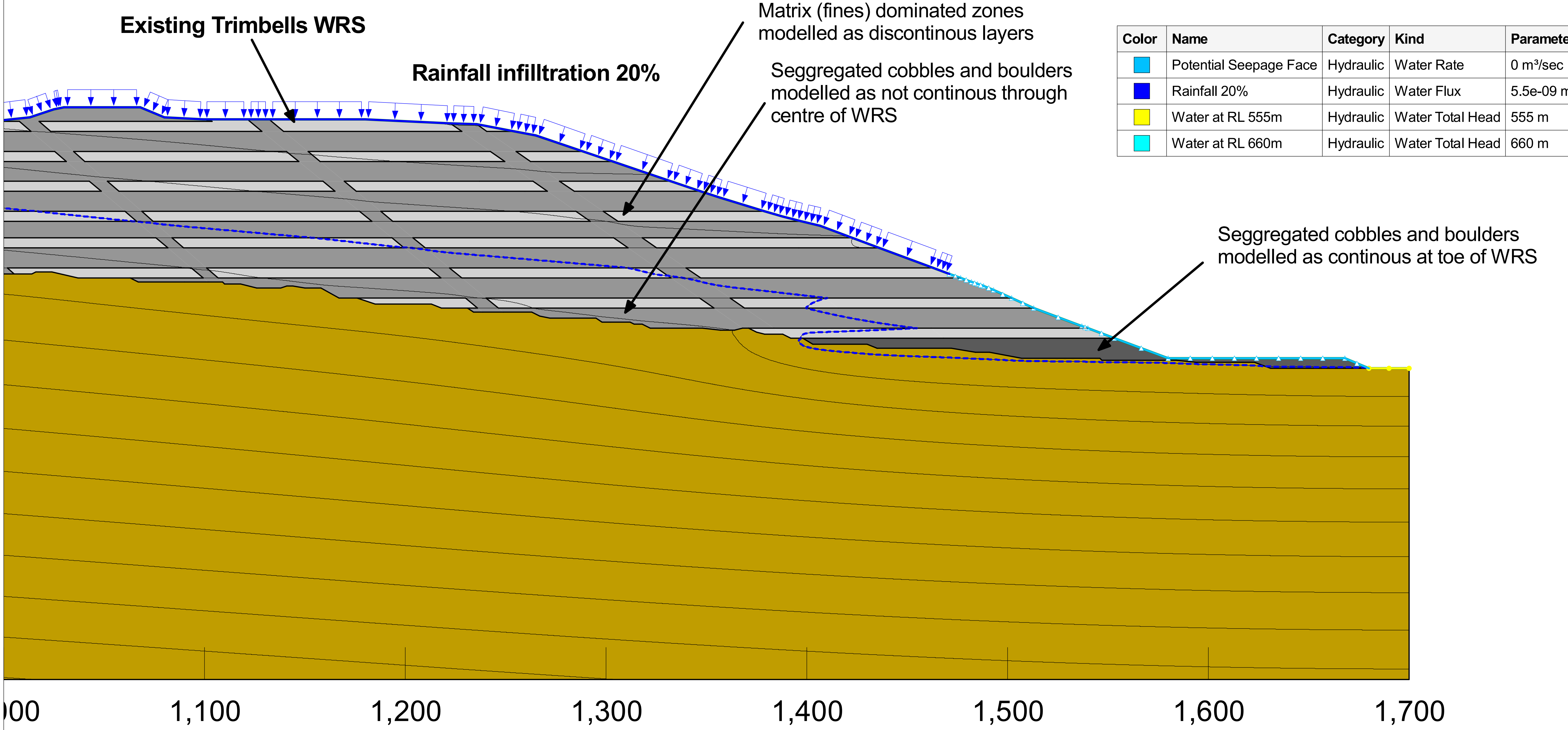
Appendix A List

Analysis Settings:

Global Element Size: 1 m

Color	Name	Hydraulic Material Model	Sat Kx (m/sec)	Ky'/Kx' Ratio
	Unweathered Schist	Saturated Only	5e-09	0.1
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Saturated Only	0.01	1
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Saturated Only	1e-06	1
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Saturated Only	0.0001	1

Color	Name	Category	Kind	Parameters
	Potential Seepage Face	Hydraulic	Water Rate	0 m³/sec
	Rainfall 20%	Hydraulic	Water Flux	5.5e-09 m/sec
	Water at RL 555m	Hydraulic	Water Total Head	555 m
	Water at RL 660m	Hydraulic	Water Total Head	660 m



Seepage analysis for pore pressure profile

Figure A01

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Date: 30/08/2024
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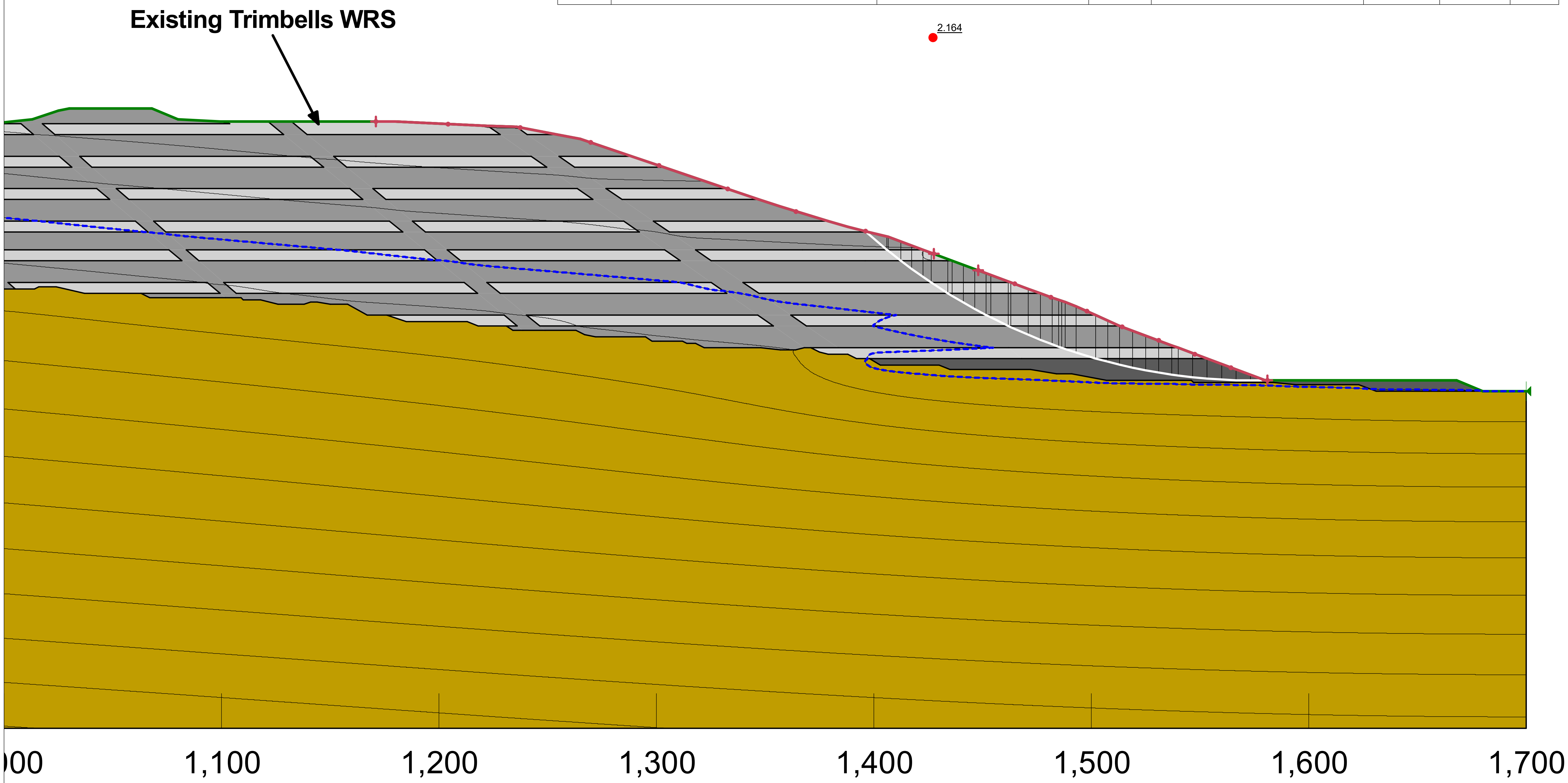
Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 2.164
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0



Stability - Static - Peak - Circular

Figure A02

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Date: 30/08/2024
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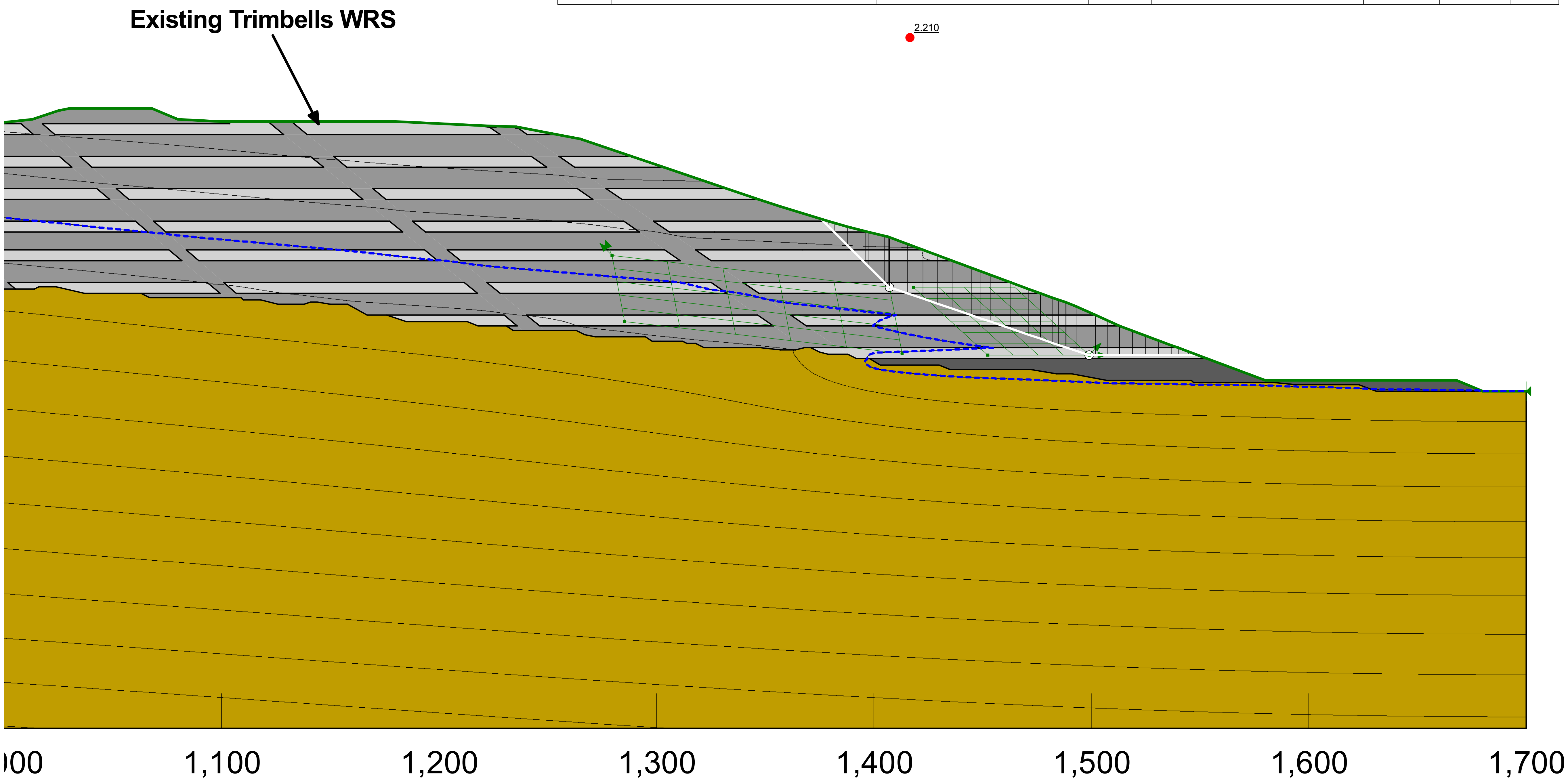
Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 2.210
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0



Stability - Static - Peak - Planar

Figure A03

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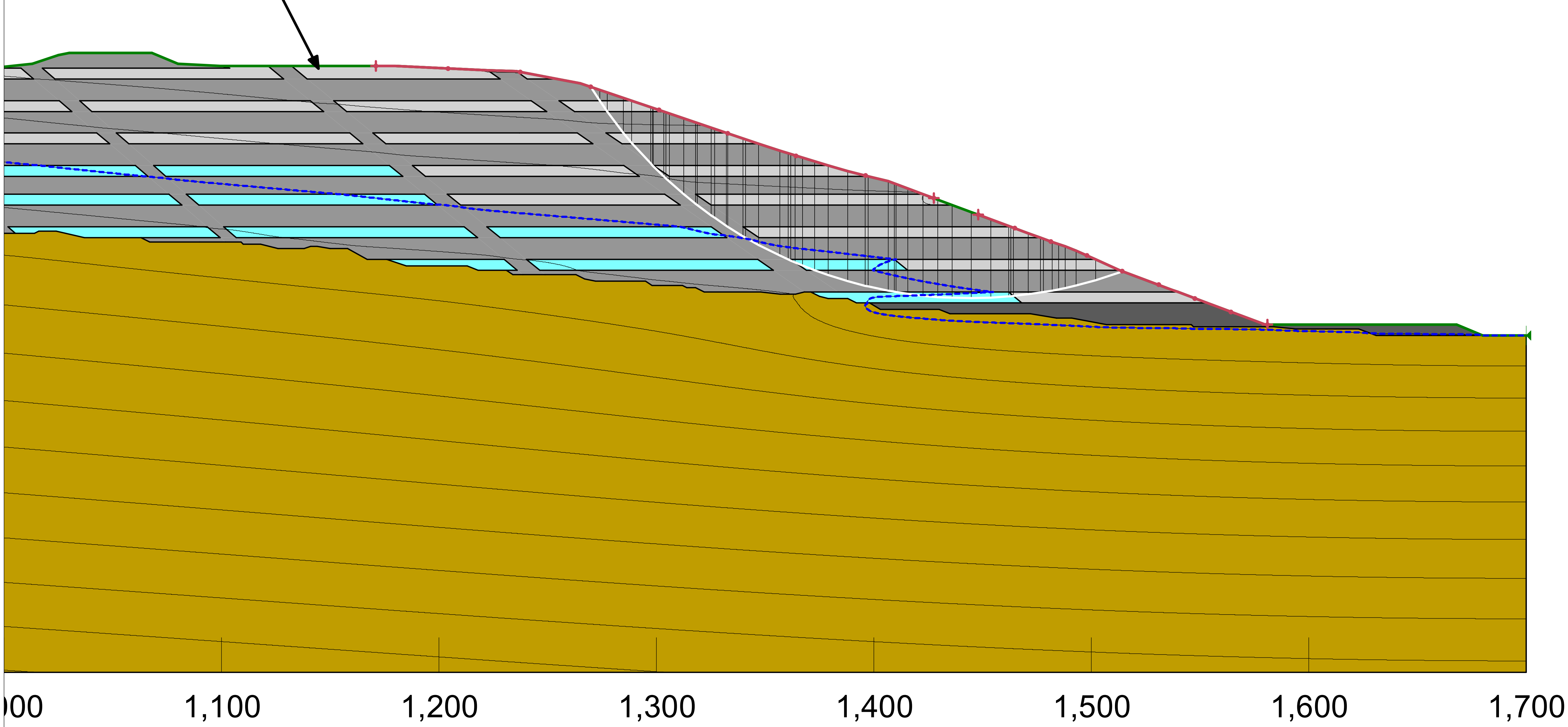
Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.955
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0



Stability - Post EQ - Softened - Circular

Figure A04

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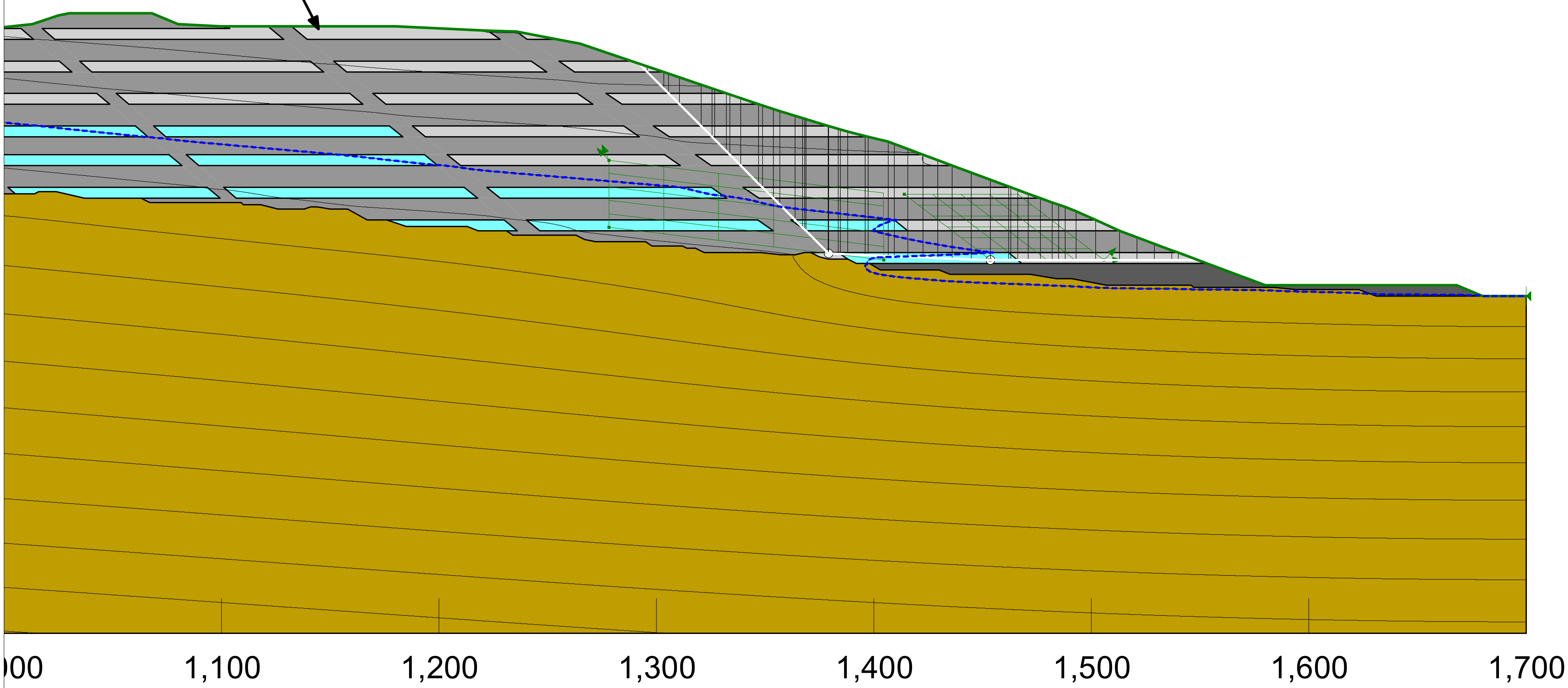
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.597
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0

Existing Trimbells WRS



Stability - Post EQ - Softened - Planar

Figure A05

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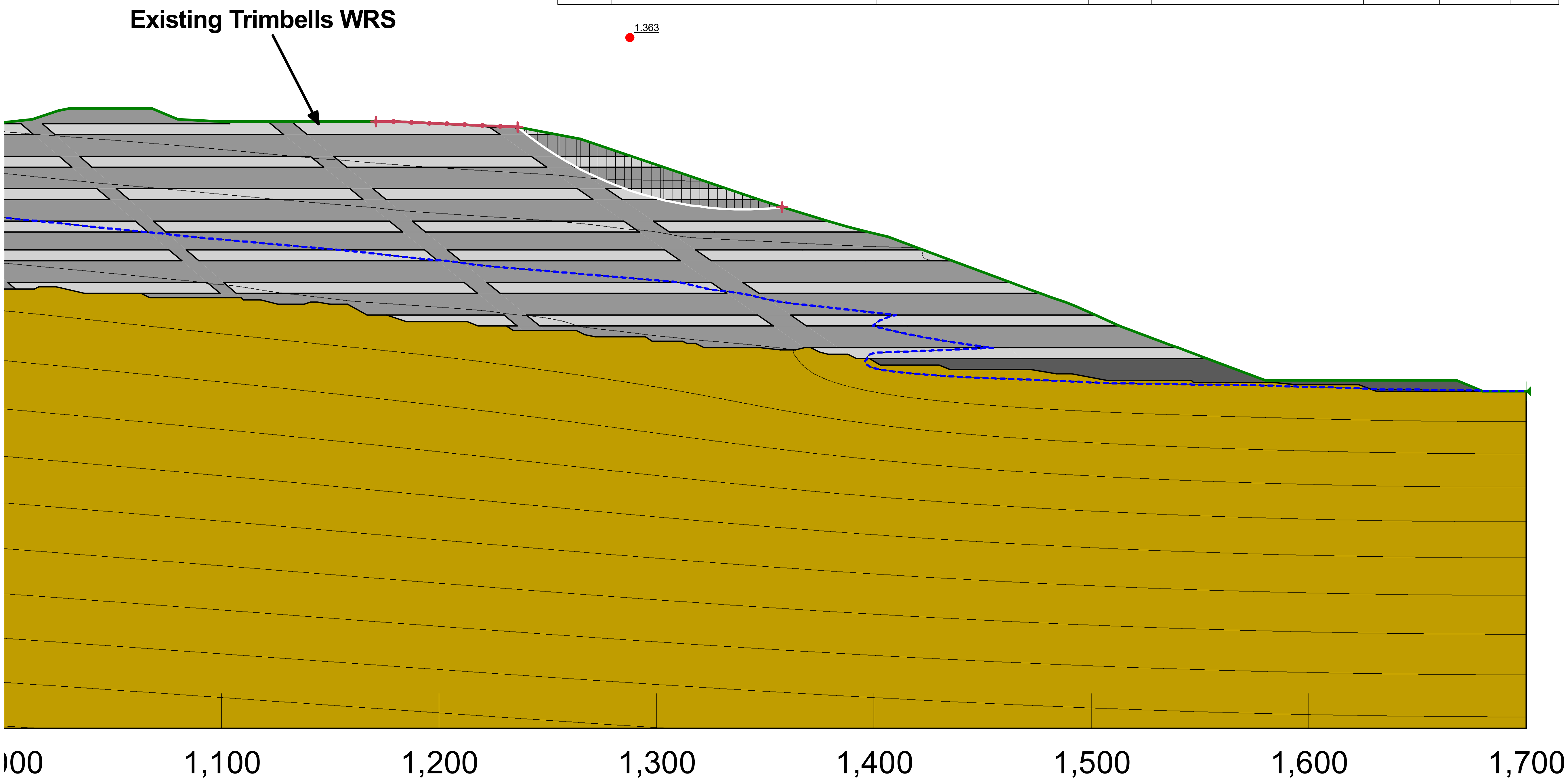
Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0

Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.363
Horz Seismic Coef.: 0.271



Stability - EQ150yr - Peak - Circular - 1/3rd H

Figure A06

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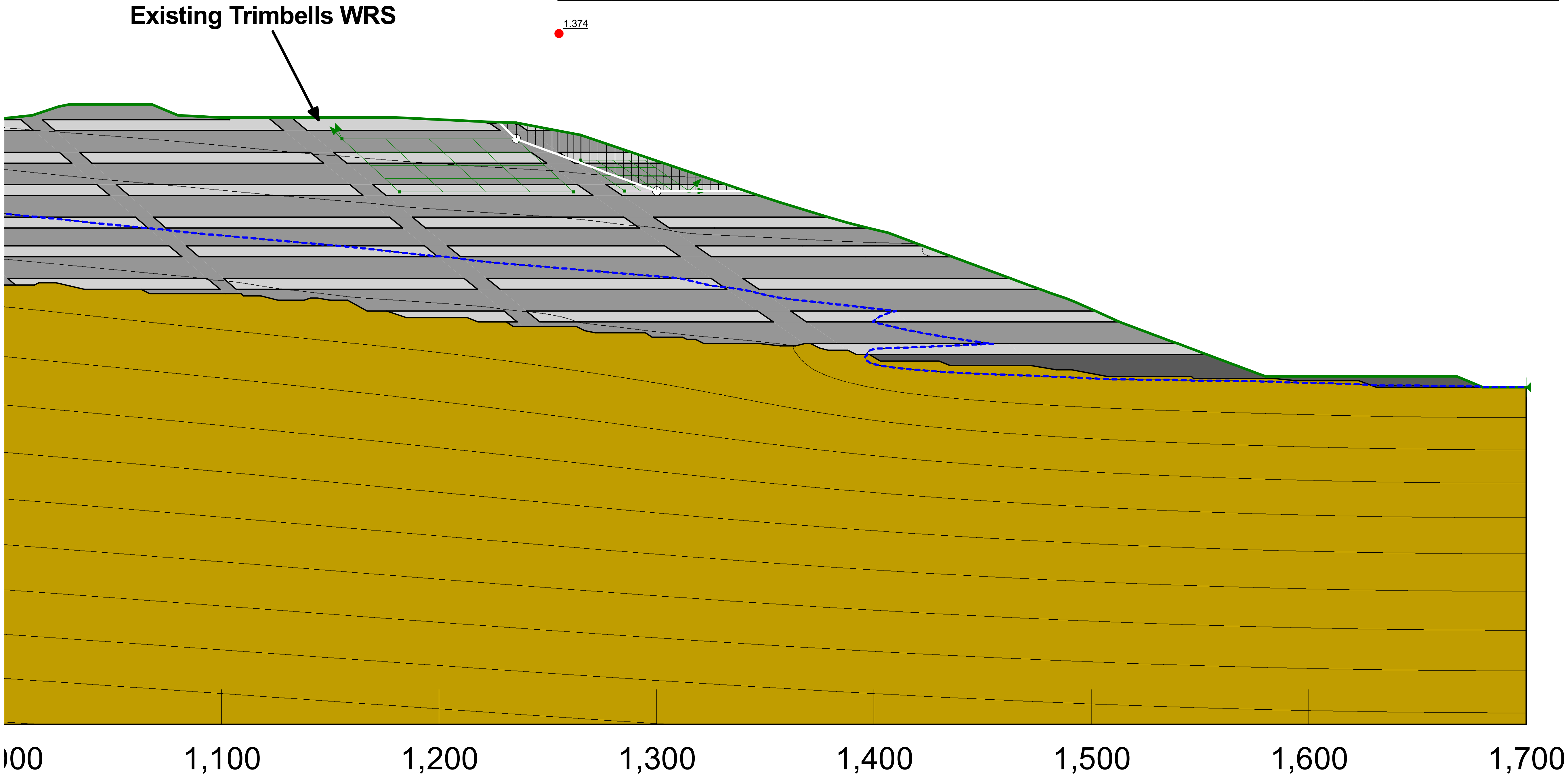
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.374
Horz Seismic Coef.: 0.271

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
(gold)	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
(dark grey)	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
(light grey)	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
(grey)	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0



Stability - EQ150yr - Peak - Planar - 1/3rd H

Figure A07

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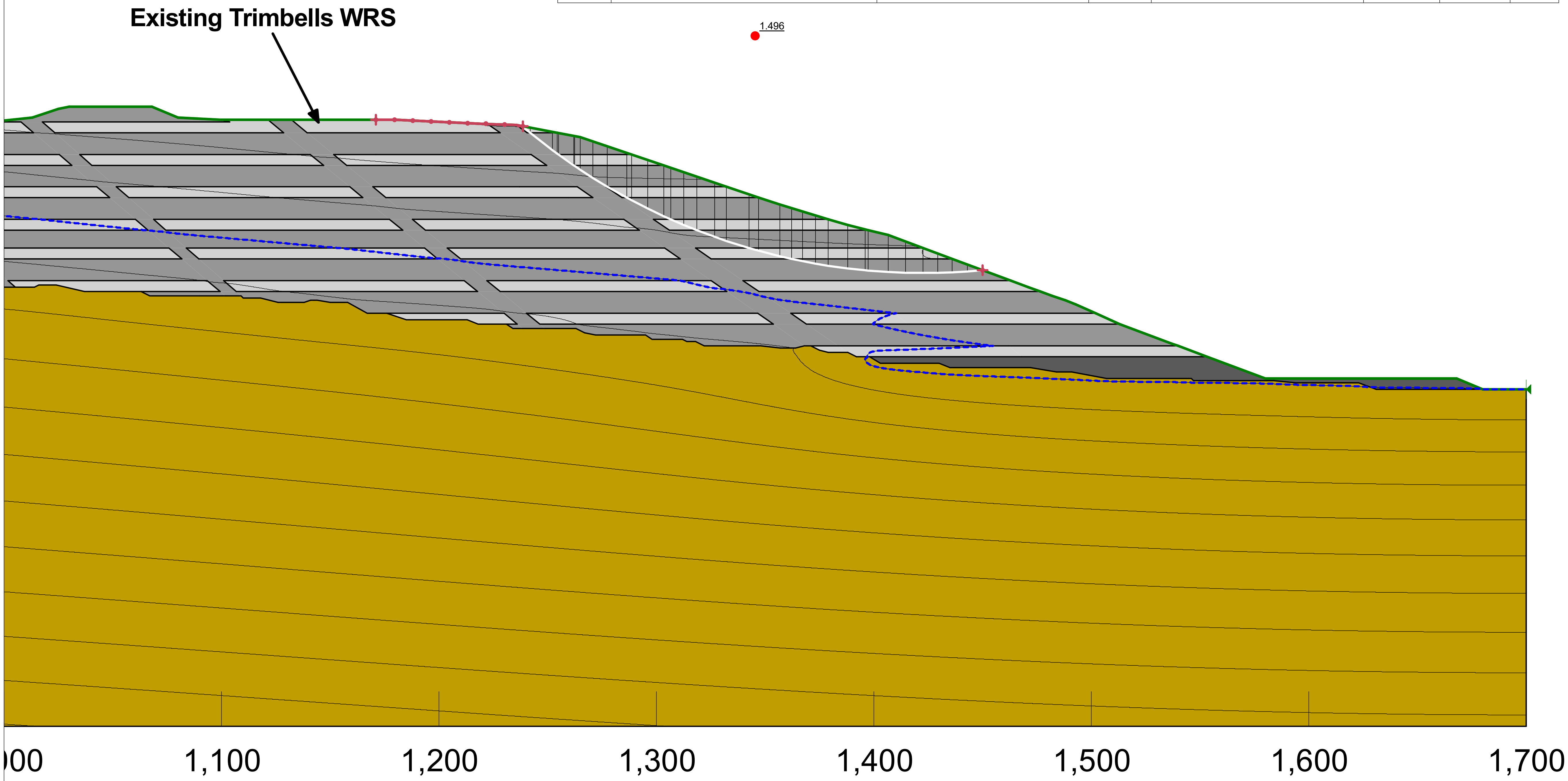
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.496
Horz Seismic Coef.: 0.2

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0



Stability - EQ150yr - Peak - Circular 2/3rd H

Figure A08

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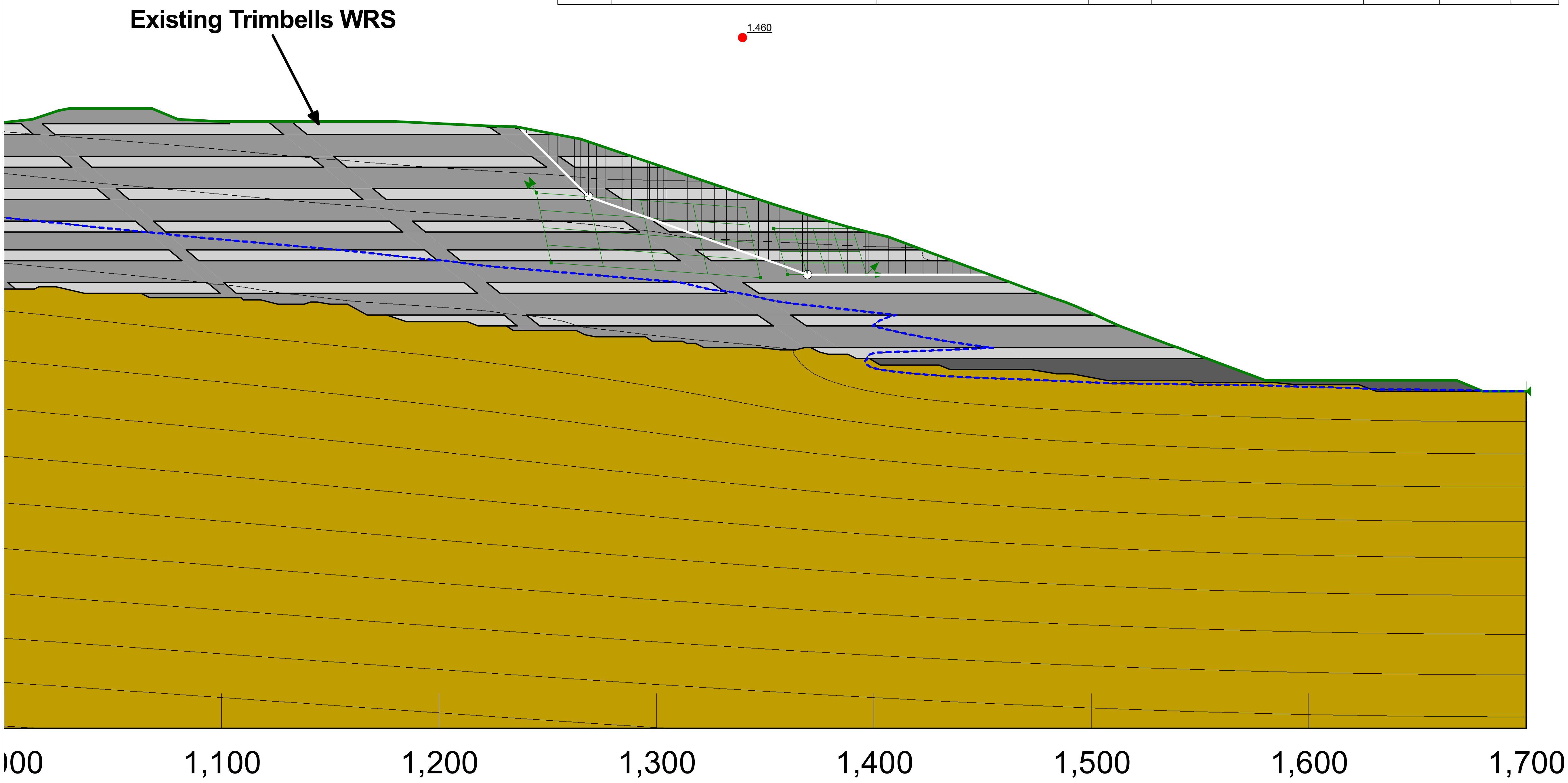
Date: 30/08/2024
Drawn: ET
Ref: 9745

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.460
Horz Seismic Coef.: 0.2



Stability - EQ150yr - Peak - Planar - 2/3rd H

Figure A09

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Date: 30/08/2024
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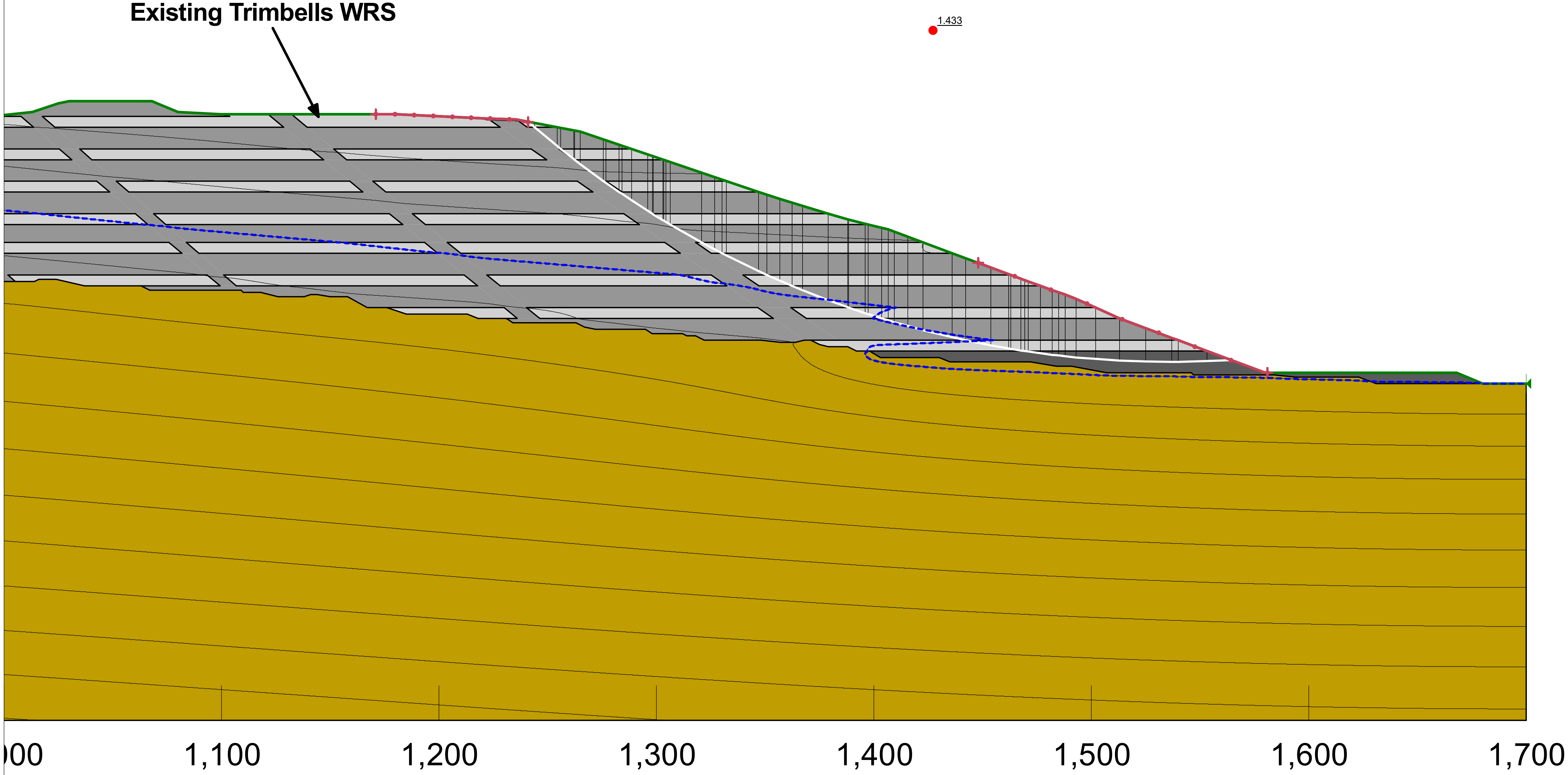
Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.433
Horz Seismic Coef.: 0.176

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0



Stability - EQ150yr - Peak - Circular 2/3rd H

Figure A10

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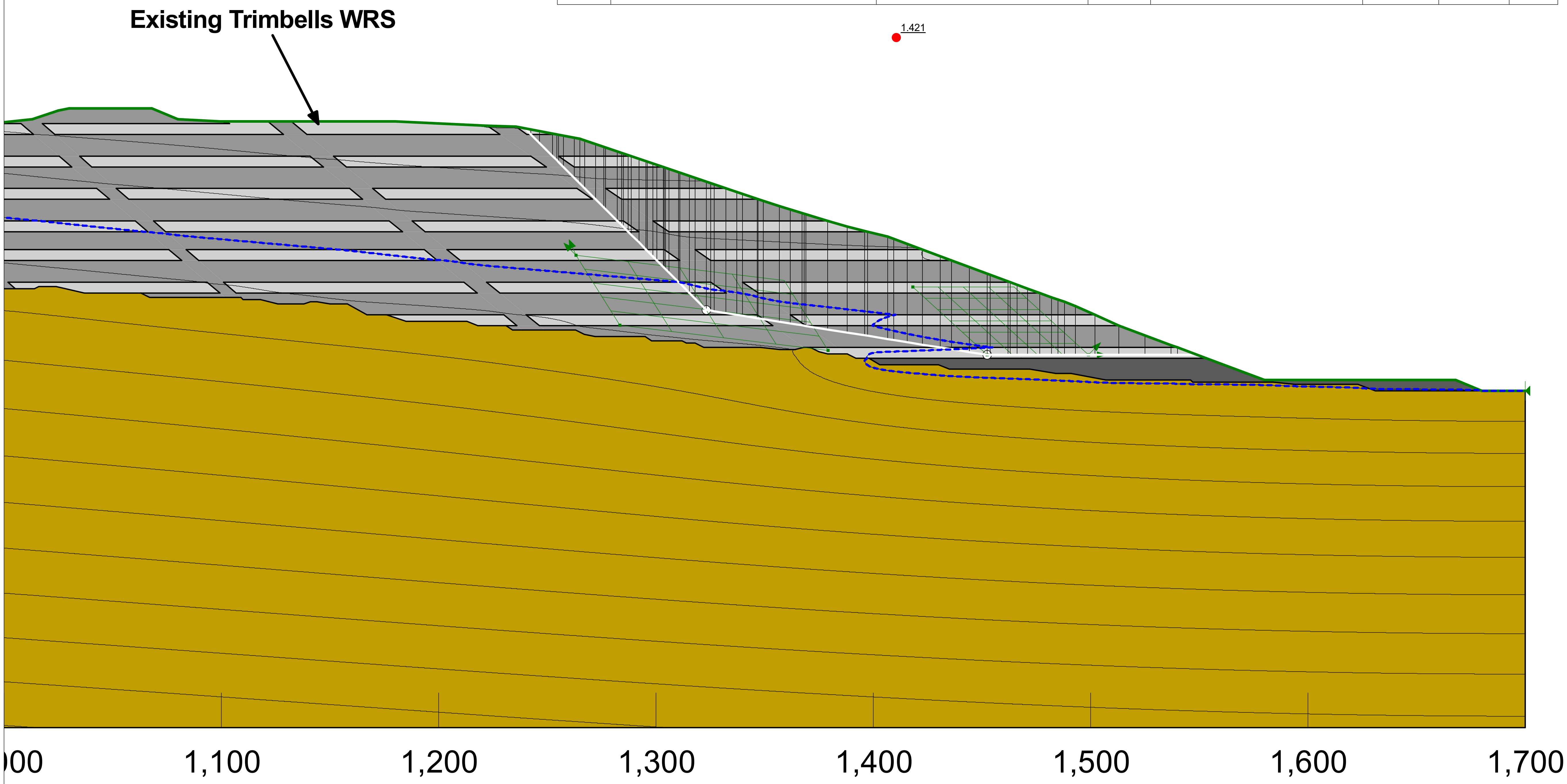
Date: 30/08/2024
Drawn: ET
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.421
Horz Seismic Coef.: 0.176

Color	Name	Slope Stability Material Model	Unit Weight (kN/m^3)	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26		150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5	Function 2 - 1.29 x sigma^0.91			0



Stability - EQ150yr - Peak - Planar - 2/3rd H

Figure A11

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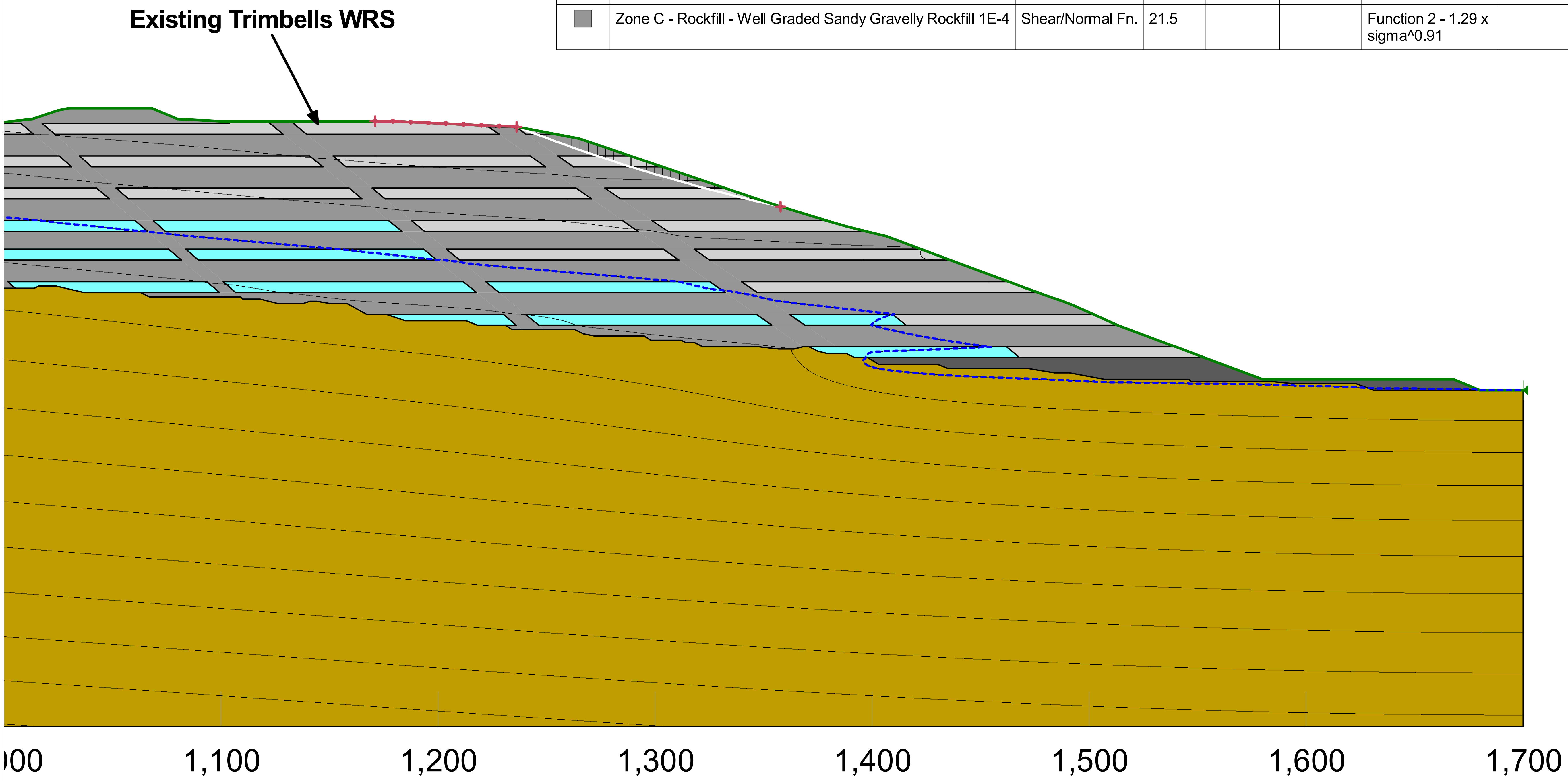
Date: 30/08/2024
Drawn: ET
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.021
Horz Seismic Coef.: 0.44

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0



Stability - ky - Residual - Circular - 1/3rd H

Figure A12

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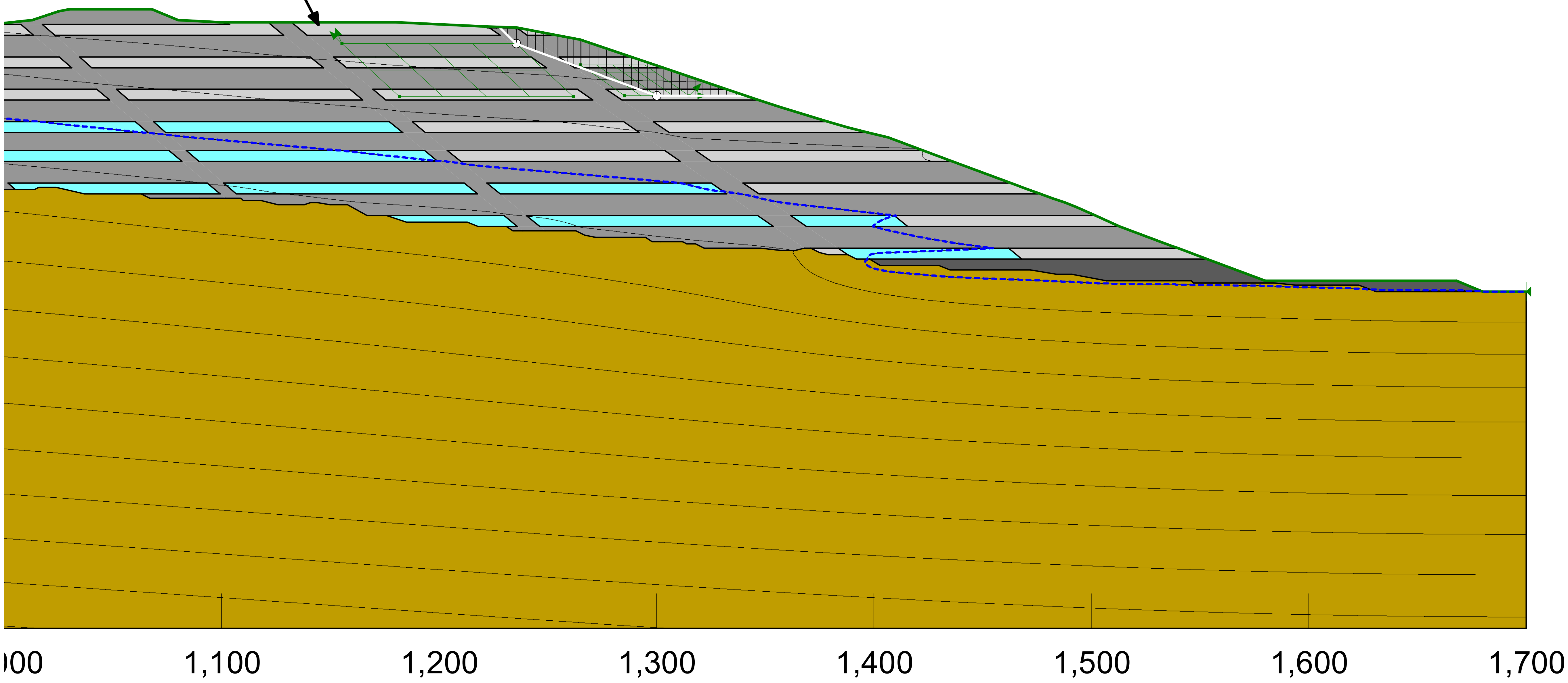
Date: 30/08/2024
Drawn: ET
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.011
Horz Seismic Coef.: 0.44

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0

Existing Trimbells WRS



Stability - ky - Peak - Planar - 1/3rd H

Figure A13

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Date: 30/08/2024
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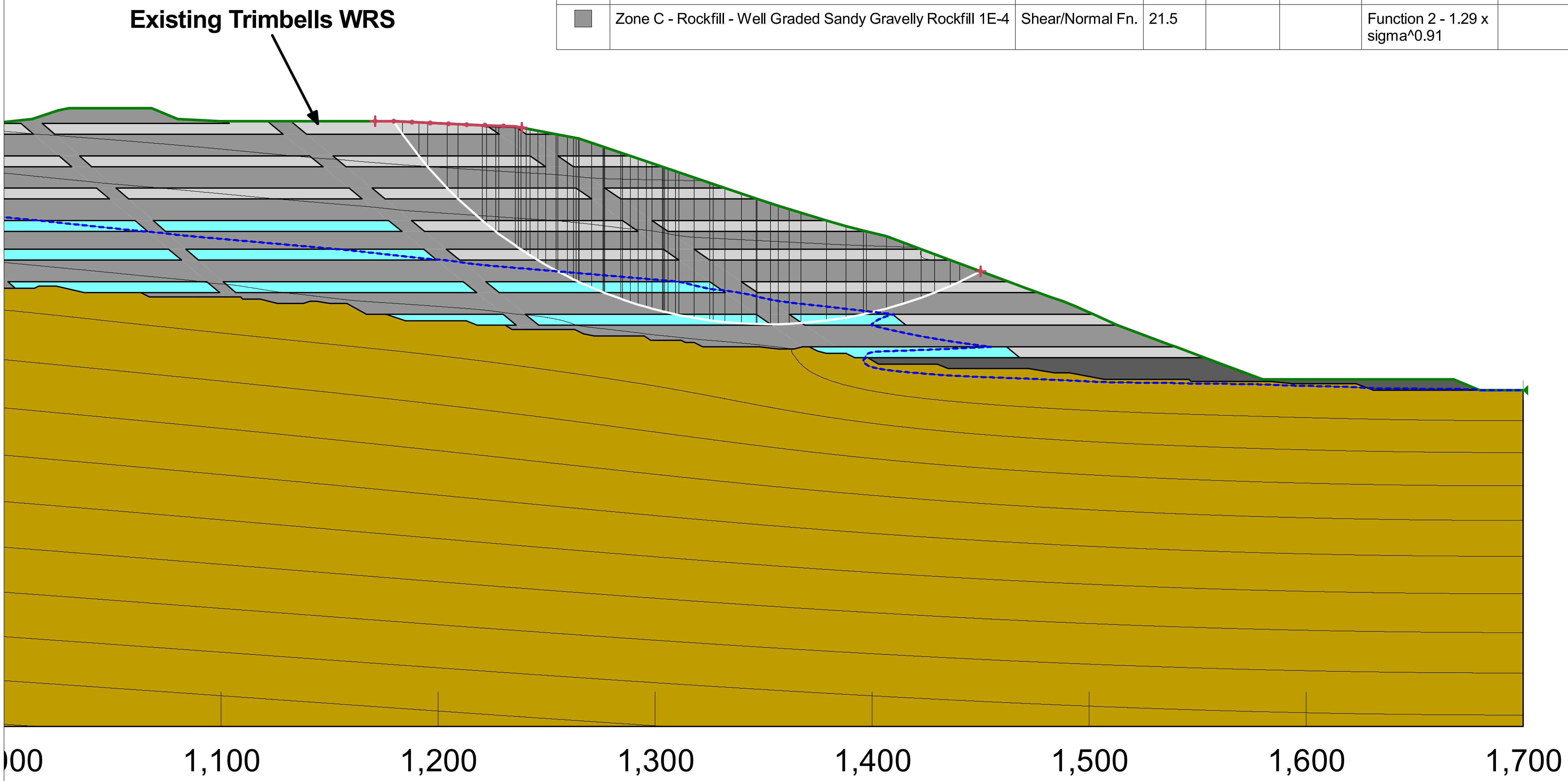
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.017
Horz Seismic Coef.: 0.37

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0



Stability - ky - Peak - Circular 2/3rd H

Figure A14

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Date: 05/09/2024
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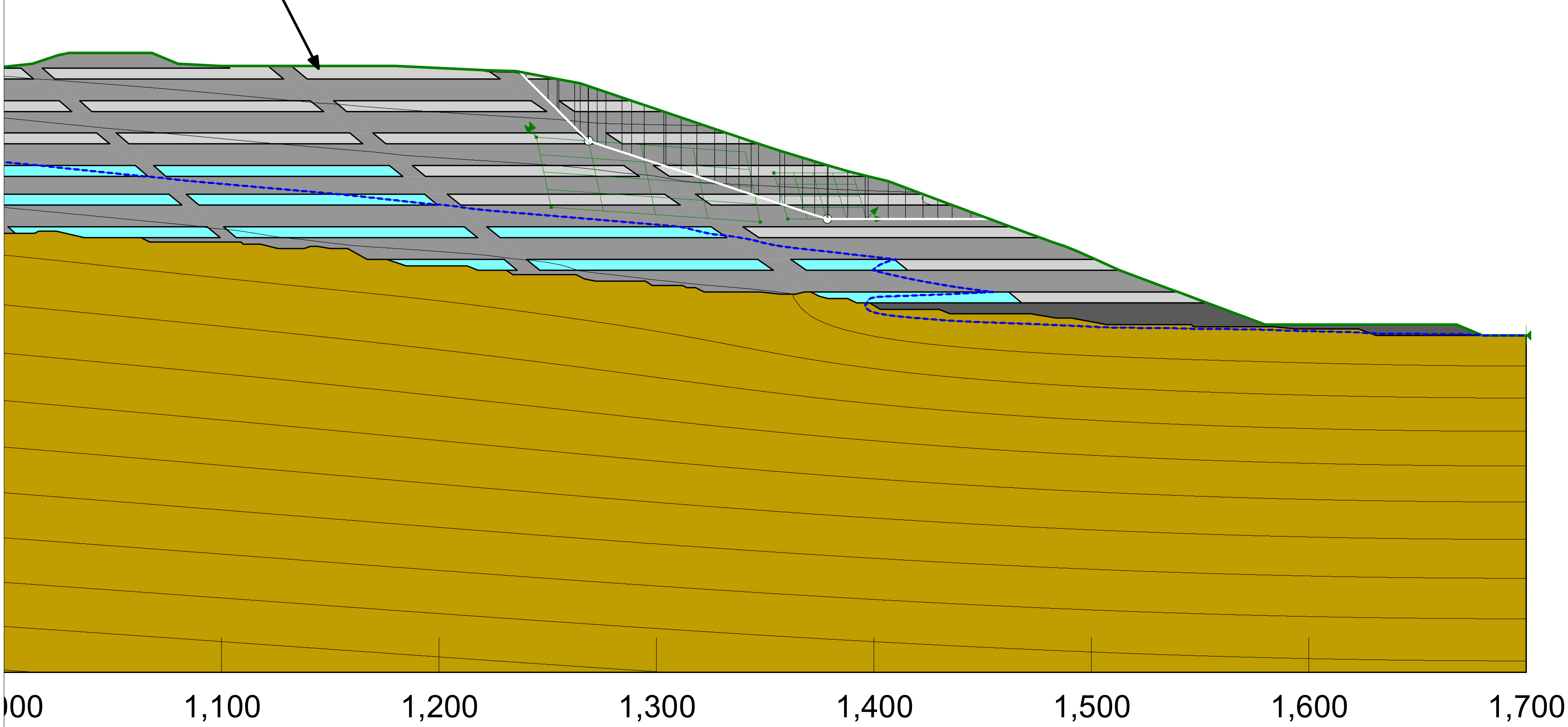
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.029
Horz Seismic Coef.: 0.38

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0

Existing Trimbells WRS



Stability - ky - Peak - Planar - 2/3rd H

Figure A15

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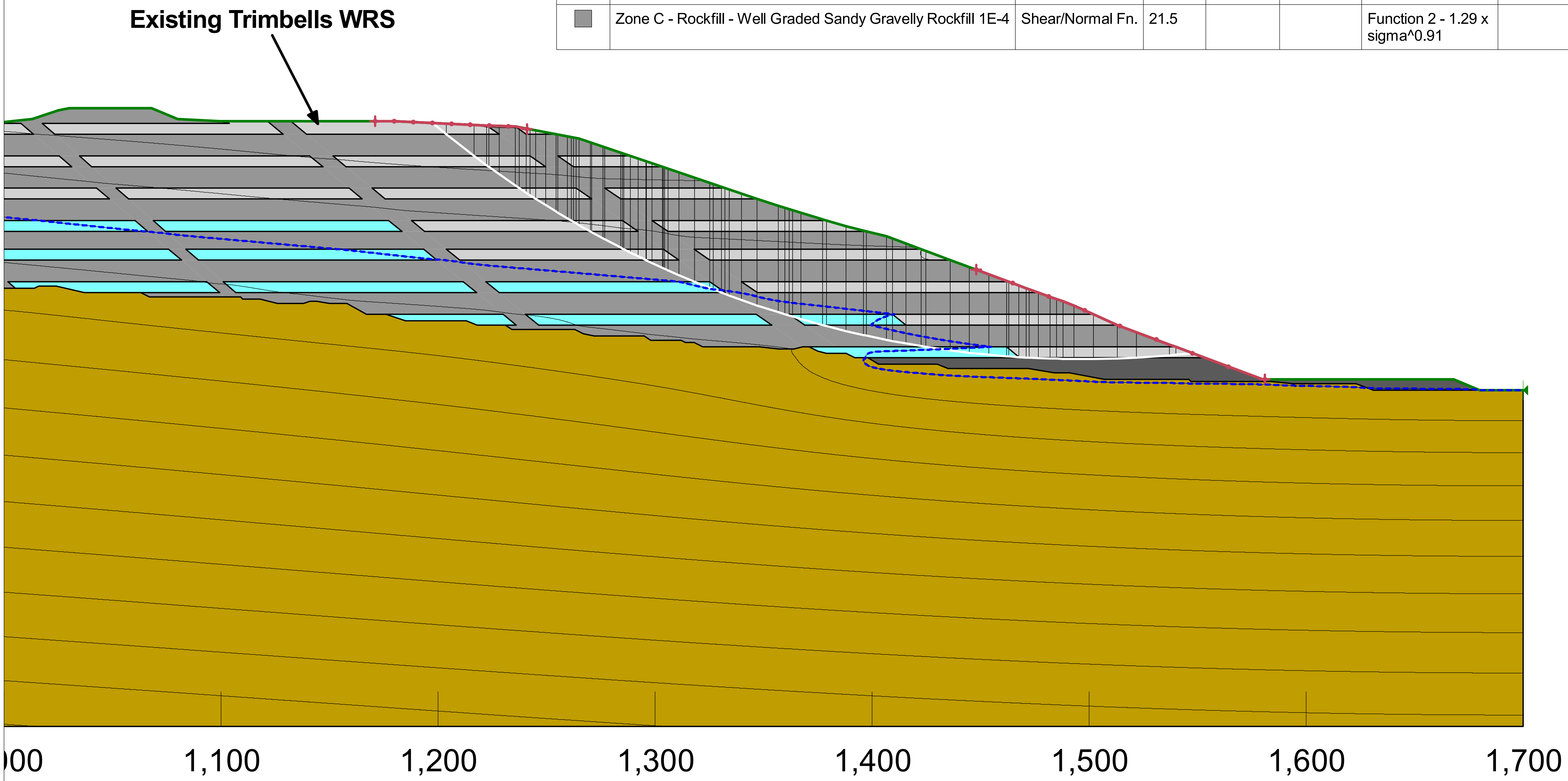
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Spencer
Factor of Safety: 1.008
Horz Seismic Coef.: 0.28

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0



Stability - ky - Residual - Circular H

Figure A16

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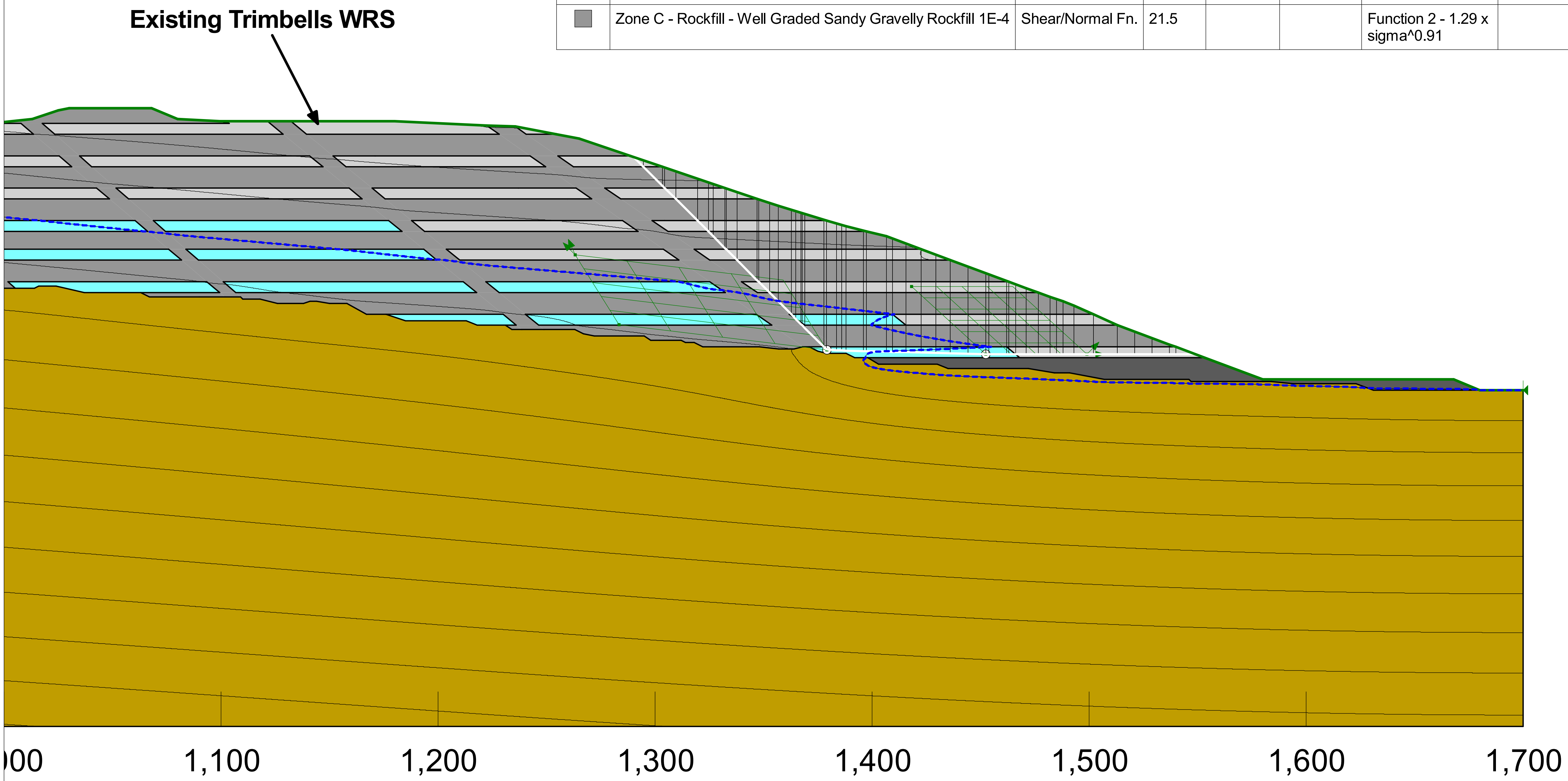
Drawn: ET
Ref: 9745

Analysis Settings:

Kind: SLOPE/W
Method: Janbu
Factor of Safety: 1.014
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Minimum Strength (kPa)	Tau/Sigma Ratio	Strength Function	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)
	Unweathered Schist	Spatial Mohr-Coulomb	26				150	45	0
	Zone C - Rockfill - Seggregated Cobbles/Boulders 1E-2	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Peak)	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0
	Zone C - Rockfill - Silty Sandy Gravel 1E-6 (Residual)	SHANSEP	21.5	0	0.2				
	Zone C - Rockfill - Well Graded Sandy Gravelly Rockfill 1E-4	Shear/Normal Fn.	21.5			Function 2 - 1.29 x sigma^0.91			0



Stability - ky - Residual - Planar - H

Figure A17

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